

**THE
RAILWAY GAZETTE**

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INCORPORATING

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ELECTRIC RAILWAY TRACTION

A Supplement illustrating and describing developments in Electric Railway Traction is presented with every copy of this week's issue

Victorian Railways Progress

IN an address entitled "The Victorian Railways Look Ahead" delivered at the New South Wales centre of the Institute of Transport recently, Mr. H. W. Clapp mentioned some of the steps which the Victorian Railways are taking to provide better service. To meet modern travel demands, said Mr. Clapp, their former ideas of railway comfort, railway speed, and types of railway carriages had been discarded in favour of the new ideas upon which the appropriately named Spirit of Progress train had been designed. Air-conditioning was now their established policy. All country carriages to be constructed in the future would be so equipped. Further they would not build any passenger stock other than of steel construction. They had not radically increased maximum speeds but had concentrated on the achievement of appreciably higher sustained speeds. They were all at school, he added, learning all the time. We might add that the Victorian Railways are not merely learning but teaching, and in this connection we would point to one of the most important though comparatively simple steps taken by the administration to provide more efficient steam haulage, namely,

the comprehensive programme of locomotive front-end improvement to which we have already had occasion to refer more than once.

* * * *

Internal Airline Co-ordination

The consolidation of those air transport interests which are concerned mainly with the operation of internal airlines in the British Isles, was advanced a further stage last week by the formation of British & Foreign Aviation Limited, a £250,000 company backed by Sir Hugo Cunliffe-Owen (Chairman of the British American Tobacco Co. Ltd.) and Mr. Robert P. W. Adeane (of the "St. Davids" group of trust companies). Among the other directors are Captain Gordon P. Olley (Managing Director of the Olley Air Service Limited) and Mr. John S. Wills (a Member of Council of the British Electrical Federation Limited). The objects of the new company are to acquire not less than 90 per cent. of the issued capital of Air Commerce Limited and the Olley Air Service Limited; the latter controls West Coast Air Services Limited and Channel Air Ferries Limited. Air Commerce may be considered the financial basis of the new concern, for this company, which was incorporated on December 1, 1934, became associated in November, 1936, with the Lord St. Davids group. Various companies in that group, of which Mr. Adeane is Chairman, hold share interests in Air Commerce, as also does the British Electric Traction Co. Ltd. Reference to the B.E.T. holding was made at the annual meeting of that company, which we report on page 1215.

* * * *

The Week's Traffics

There was a drop of £156,000 in the receipts of the four main line railways for the past week, and the only exceptions to the tale of decreases were the increases in passenger train earnings on the L.M.S.R. and L.N.E.R., and in coal on the L.M.S.R. For the 24 weeks of the current year the combined traffics of the four companies amount to £70,408,000, a decrease of £1,403,000 or 1.95 per cent. This aggregate decrease is made up of £154,000 in passenger train traffic, £926,500 in merchandise, and £322,500 in coal. The solitary increase is one of £4,000 in passenger train earnings on the L.M.S.R., and the smallest passenger decrease is that of £27,000 on the Southern.

	24th Week				Year to date	
	Pass., &c.	Goods, &c.	Coal, &c.	Total	Inc. or Dec.	%
L.M.S.R. ..	+ 28,000	- 67,000	+ 4,000	- 35,000	- 617,000	- 2.12
L.N.E.R. ..	+ 1,000	- 53,000	- 19,000	- 71,000	- 473,000	- 2.21
G.W.R. ..	- 5,000	- 28,000	- 7,000	- 40,000	- 230,000	- 1.91
S.R. ..	- 2,000	- 5,000	- 3,000	- 10,000	- 83,000	- 0.89

London Transport receipts for the past week were £575,300, an increase of £18,200, bringing the total increase for the 51 weeks to date to £645,100.

* * * *

Port of Bristol Authority

A continuance of expansion in trade was enjoyed by the Port of Bristol Authority during the year ended March 31, 1938, as shown by the recently published accounts and statistics. The number of foreign vessels using the port rose from 1,088 in the previous year to 1,129, and their register tonnage improved from 2,819,995 to 2,833,489, and coastwise there was an advance from 6,969 to 7,277 in the number of vessels and from 913,348 to 971,849 in register tonnage. Foreign imports increased from 2,844,873 tons to 2,967,774 tons and foreign exports from 55,680 tons to 66,029 tons, and coastwise trade showed a general improvement, namely, from 1,034,966 tons to 1,171,385 tons in imports and from 558,478 tons to 605,566 tons in exports. From dues on vessels and on goods the receipts

of £188,508 and £260,057, respectively, were the largest of recent years. Discharging and loading vessels, and landing and shipping cargo brought in £258,025 against £253,301, and warehouse rents, &c., improved from £76,290 to £80,165, but the amount received from the railway companies in respect of interchange traffic fell from £19,161 to £17,169. The gross revenue of £904,115 and the net revenue of £335,671 were the highest since the alteration in 1927 of the date of closing the financial year. In order to cover interest and sinking fund charges, &c., the amount required from the general rate is reduced from £40,000 to £35,000.

* * * *

The Grantham Canal

An interesting proposal is under consideration for the conversion into a highway of about 1½ miles of the Grantham Canal belonging to the London & North Eastern Railway. The section proposed to be filled in lies between Trent lock close to Nottingham, and Gamston bridge. For many years past this canal of 33 miles running from the River Trent, south of Nottingham, to Grantham, which was authorised by an Act of 1793, has ceased to be used as a navigation. In 1905 the tonnage conveyed over it was only 18,802 tons and its total revenue was only £250. By section 38 of the London & North Eastern Railway (General Powers) Act, 1936, the company was empowered to close the canal for traffic purposes, and on payment of £2,100 was relieved of the obligation to maintain the bridges over the canal, which obligation passed to the county councils of Nottinghamshire and Leicestershire. But the company is still left under the obligation to maintain the reservoirs and the works connected therewith, and so to maintain the portion of the canal within the River Trent catchment area that the use of that portion of the canal as an efficient part of the land drainage system of that area shall not be impaired and that (subject to unavoidable cause or accident or unusual drought) the depth of water shall not be reduced below two feet.

* * * *

Wisdom from Glasgow, 1938

In the hope of learning something we did not already know we hunted through the many papers recently presented at Glasgow on the occasion of the International Engineering Congress. For railwaymen there was very little of direct interest in these papers, but of propaganda as distinct from information there was plenty. Thus in one paper by an electrical engineer appears the remark, "No one would seriously contest the superiority of electric traction over the other systems in use." In another paper, also electrical in flavour, appears the remark, in reference to the now historical Report of the Weir Committee on Railway Electrification, "it is unfortunate that up to the present the recommendation of the committee in favour of complete main-line electrification has not been accepted." The railway people are fools seemingly, and may they not also be regarded as villains? To quote from another paper, "the terminal stations and locomotive sheds of steam-operated railways now contribute the greater part of the soot and dirt in our big cities and towns." Some people went all the way to Glasgow to hear this sort of thing. We have always been able to get all the blather we need from our own radio at home.

Chalk Talks

Special mention is made in the June issue of *Quota News*, the journal of the L.M.S.R. Commercial Department, of the good work done by station staff in designing effective blackboard announcements. These range from advertisements of excursions to "safety first" advice for

hurried suburban passengers, and their message is reinforced by drawings which catch the eye both by their workmanship and their cleverness in adapting topical interests to the service of railway publicity. *Quota News* warns the ingenious artists concerned not to be disappointed if their efforts do not bring an immediate increase in the contribution of their stations to the district quota; the blackboard announcement has a psychological effect that must be measured over a period. Less formal than the printed poster or handbill, it helps to create that friendly relationship between railway and passenger which is also the aim of the company's commercial representatives. But the blackboard message reaches the private individual who may never be concerned with arranging outings or sending traffic in bulk, and so would otherwise miss the sense of personal contact with the railway enjoyed by those favoured with the attentions of the company's transport salesmen.

* * * *

Hungry Garston

Garston Docks, it is maintained in a recent article in *Quota News* (the journal of the L.M.S.R. Operating Department) have several claims to eminence—and notoriety. The docks are notorious, the author, Mr. R. D. Roberts, the Docks Superintendent at Garston, points out, because they are always hungry—welcoming wagons, calling for chains, sighing for sheets, and roaring for ropes. Feeding this "brute" is indeed a problem. The reason for Garston's astonishing appetite for these essential foods of railway life is made clear by the fact that the docks claim, with 3,024,094 tons, the "handled tonnage" record of the L.M.S.R. system. Timber is the principal commodity and during the peak of the season upward of 1,500 wagons are loaded daily, often requiring as many as 600 sheets and 1,000 ropes. During a recent week 6,000 loaded wagons were on hand. For the season upwards of 2,000 transport workers are employed. "Have a banana" is a music hall phrase not to be spoken lightly in Garston, where last year 8,597,934 bunches arrived in 73 ships. Bananas can be discharged from Elder & Fyfes steamers at the rate of 8,000-9,000 bunches an hour. Gangs of men often unload timber from ships at the rate of 3,000 tons in the course of a day, others discharge pyrites at the rate of 2,500 tons in a stretch of eight hours. On the export side 1,200,000 tons of coal were shipped in 1937 from Staffordshire, Notts, Derbyshire, Lancashire, and Yorkshire collieries.

* * * *

Notable Time Recovery on the L.M.S.R.

No fewer than 28 min. were regained by locomotive No. 6209, *Princess Beatrice*, a Stanier 4-6-2, during a run from Carlisle to Euston recently with the 12.16 p.m. express from Perth, which on this occasion was loaded to about 420 tons. The train was 22 min. late leaving Carlisle, and, not only was the whole of this deficiency made up, but also 4 min. lost immediately by traffic delays, and the arrival at Euston was 2 min. early. Excluding the time spent standing at Lancaster and Crewe, the only two intermediate stops, the overall running time for the 299.1 miles amounted to 302½ min. Time was made up on this journey not by high speeds on favourable gradients—the fastest was 79 m.p.h.—but mainly by a sustained high average and good running uphill. This feat of time recovery is the more creditable by reason of the fact that the engine was concluding a through journey of some 400 miles. Such examples of making up lost time are becoming more common on British railways than they were a few years ago, and if they are possible occasionally they should be possible regularly, as they are on

the Continent, where late starts are normally converted into punctual arrivals without particular comment on the part of passengers. The On Time movement of the L.M.S.R. is doubtless largely responsible for the improvement in time-keeping on that system.

* * * *

Faster Southern Electrics

It is in the substantial reduction of average journey times, coupled with the increased frequency of service, that the long-distance electrification of the Southern Railway has been of most benefit to the South Coast. Few of the fastest times between London and South Coast resorts have been reduced, although in recent timetable revisions, and particularly in the July alterations reviewed last week, there is a tendency to pare the best schedules. The quickest journey from London Bridge to Worthing, for example, is cut from 79 to 72 min., and to Bognor from 99 to 87 min., Lewes is reached in 57 instead of 58 min., and Eastbourne in 79 instead 80 min.; while for the first time on record a 56-min. schedule from London Bridge to Brighton (the 5 p.m. City Limited) appears in the working timetable, though the published time still remains at 60 min. As to average times, the cut achieved between the London terminals and Bognor is fully 20 min., but it is to be hoped that the time may ultimately come when full advantage of the electrification is taken in the speed realm, as has been done in the Pennsylvania electrification of which modern performances were described in the June 10 issue. Admittedly the Southern speed problem is more difficult, because of the stopping services which have to be sandwiched in, and the two-track bottleneck south of Balcombe tunnel.

* * * *

The Mile-a-Minute Standard

With the introduction of the summer timetables the Great Western Railway has effected a considerable increase in the total mileage of its services which are booked daily at speeds of over 60 m.p.h. from start-to-stop. In certain cases an adjustment of a single minute in a timing has been sufficient to transfer a train into the mile-a-minute category; but, as we have previously emphasised, though such alterations may appear to be conceived partly, at least, in the interests of publicity, they are of value in the practical evidence that they afford of the recognition of 60 m.p.h. as a reasonable standard for present-day rail travel between stops. Some of the new G.W.R. times are faster than any previously scheduled on that system; for example, the 95.6 miles from Westbury to Paddington in 92 min. and a 3-hr. run up from Exeter (173.5 miles) with two intermediate stops are both unprecedented; over a longer distance, 3¾ hr. from Paddington to Swansea is the fastest time yet tabled, 12 min. better than any previously in force. The last-mentioned forms part of a very substantial improvement in the direct steamer services from Fishguard to Waterford and Cork, whereby the passenger has the advantage of leaving Paddington at 6.55 instead of 5.55 p.m., but reaches both Waterford and Cork at the same times as before.

* * * *

Evolution of Steel

Mr. C. K. Everitt, Chairman of Edgar Allen & Co. Ltd., in a lecture at Sheffield on "Half a Century of Steel Manufacture" described conditions when as a boy in 1881 he worked in the crucible process. In those days there was little or nothing in the way of chemical analysis to guide the men in the steel they produced. Their skill

in the selection of what they called temper, which really meant the carbon content of the converted Swedish iron (blister steel) and which they broke up into small pieces, was astounding. After the ingots had been cast and the top end broken off, they had again to judge the carbon content by the appearance of the fracture. Mr. Everitt's first recollection of any chemical check was having several ingots drilled and the drillings sent for analysis. It was remarkable, he said, how nearly the analysis compared with the judgment of the melter. Somewhere about 1885 Mr. Everitt came in contact with that great pioneer of the microscope, Dr. Henry Clifton Sorby, and supplied him with several samples of carbon, tungsten and chrome steels. Dr. Sorby's work opened up a knowledge of the structure of steel and showed how by heat treatment that structure could be radically altered or amplified with very pronounced results in its mechanical behaviour. Dr. Sorby's early work was the real foundation of the heat treatment of steel.

* * * *

An Exhaust Turbine for Locomotives

High pressure steam cannot be economically expanded down to atmospheric pressure in a single-stage reciprocating engine, and for this reason numerous attempts have been made to evolve a satisfactory alternative to the ordinary simple expansion locomotive. Compounding offers important advantages, but loading gauge restrictions have so far prevented the development in Great Britain of such powerful engines on the compound principle as can be built for working simple. A possible alternative to low pressure cylinders in a locomotive is a turbine, and elsewhere in this issue an arrangement is described in which steam from two high pressure cylinders passes to one of these machines, and is expanded to a point where the residual energy is still sufficient for providing a blast. The turbine axis is parallel to the cylinder axes, and therefore a mitre wheel drive is required. Also incorporated in the drive is a hydraulic coupling and this is to give all the working parts a very desirable immunity from shock. A quill drive, enabling unsprung weight to be kept very low, is a further commendable feature of the design. Reversal is effected by transferring fluid from one hydraulic coupling to another, though this is primarily an unnecessary complication. A sliding dog between loose bevels on the quill-driving shaft should give the necessary facility for reversing, the arrangement being one used already in innumerable diesel railcars and locomotives.

* * * *

A Railway Reptile

A venomous-looking snake, coiled in a graceful spiral round a lamppost on the L.M.S.R. station at Llanfairfechan, near Bangor, no longer brings forth cries of curiosity and fear from the vivacious Celts parading the platform. They have discovered it to be a spurious serpent. Far from being some jiggery-pokery by a Welsh wizard, cunningly constructed by the station staff from a suitable length of hosepipe, this oddity is intended to be a seductive serpent who, as this station has entered the best-kept station gardens competition, will it is hoped whisper temptingly in the ears of the judges that Llanfairfechan's horticultural display has charms far exceeding those of neighbouring Llanfairpyllgwyngyllgogerychwyrndrobwllllantysiliogogogoch (Llanfair for short) or any other competing L.M.S.R. station in the North Wales area. After this, and we trust it will succeed in its mission, Rhys the Reptile, as it should surely be named, might employ its wiles to insinuate to passers-by that "It's Quicker by Rail" or that *via* L.M.S.R. is "The Best Way."

The Castlecary Accident

IF ever there were a railway accident in which that incalculable quantity the "human element" played more than one part that will never be satisfactorily elucidated, it must be that at Castlecary, L.N.E.R., on December 10, 1937. It was unfortunate in other respects, being the worst for persons killed, and probably for destruction done, on the railways of Great Britain since the troop train disaster at Gretna in 1915; and the second worst since that at Armagh in 1889, which led to the passing of the legislation upon which the main features of the railway safety measures observed in this country have ever since been based. Lieut.-Colonel A. H. L. Mount's report on the occurrence has now been issued, and a summary of it appears on page 1207. The extent of the inquiry he found it necessary to hold is shown by the unusual length of the text, the series of diagrams accompanying it, and the quantity of verbatim evidence reproduced, and this was in great measure necessitated by the contradictory nature of the statements made by several of the witnesses, of whom no fewer than 34 were heard on the weather alone.

The train which was run into, the 2.0 p.m. Dundee to Glasgow express, was stopped out of course at Castlecary, a goods train being in the section ahead as the result of delay occasioned farther on by inability to operate a facing point lock bar in consequence of the snow; but the Dundee train did not stop until it had overrun the home signal and been pulled up on the exhibition of a red hand lamp from the signal box. It came to a stand with the engine tender level with the starting signal, and the trainmen emphatically declared it was not moved thereafter. In this position it was standing on a track circuit extending some distance in rear of the signal, which locked the home signal lever but did not control the block instrument. The engine driver asserted that the distant signal was "off" for him, although his language to other trainmen soon after the collision appears to have been rather more qualified than it was to Colonel Mount. He did not see the home signal, but caught sight of the emergency red lamp, and a test showed that he must then have stopped with all possible expedition. The signalman, it should be noted, not only declared that the distant signal was "on," but that he could see by the speed at which the train was approaching that it was not going to stop; he therefore exhibited his red hand lamp and blew a whistle to attract the driver's attention. The signal was 777 yd. from the box in a straight line. It had no repeater, but the backlight was, of course, ordinarily visible from the box. The signalman maintained that he saw it before the train was accepted. The backlight blinder was, however, shown to be out of adjustment to the extent of allowing the arm to fall by 29 deg. before the light was completely obscured.

The signalman at first thought that the train had run right on, and transmitted the appropriate bell signal to the box in advance, but did not look out of the window to confirm his supposition. He asserted that the track circuit indicator showed "clear," and, although expecting the Dundee train to collide with the goods train, he consulted the signalman in the rear as to the propriety of accepting the following 4.3 p.m. Edinburgh to Glasgow express. That signalman's reply was that if, as his colleague asserted, all the Castlecary signals were "on," the necessary distance was clear beyond the home signal, and the tail lamp of the Dundee train had been seen, there was nothing in the regulations to prohibit such acceptance, but he advised putting down detonators as a precaution. The Castlecary signalman did not follow the last part of this advice then, but did accept the train in

the regulation manner, of course first duly giving "train out of section" for the Dundee train. It was a very strange thing to do, even in the belief that the line at his station was perfectly clear, when he was expecting a collision in the section in advance; and his plea of wishing to avoid delay seems odd in the circumstances. When the Dundee train passed him the signalman sent for the stationmaster, who said he observed it on his way to the box and thought the tail light was beyond the starting signal, in which he was supported by a clerk. The fireman, however, came to the box about this time and announced the real position of the train, but the evidence as to precisely what transpired in the few minutes remaining before the accident is conflicting, and it seems uncertain when, or even quite how, it was that the true position of affairs dawned on the two men.

By about the time the "entering section" signal was received for the Edinburgh express, they had decided to put down detonators and appear to have been entertaining the fear that it also might not stop. The driver who had an astounding escape, declared that the distant signal was "off." Like the driver of the Dundee train, too, he missed the home signal, but saw the red hand lamp shown by the signalman and heard the one detonator the latter had managed to fix properly. It may be observed, as a comment on the efficiency of tail lamps, that the driver did not see that of the Dundee train until he was almost upon it. The brakes had barely time to take hold when the crash came. Its effects were appalling. The rear three vehicles of the Dundee train were utterly demolished and the front three of the colliding train actually rode over the locomotive, itself buried on its side in the bank, the first two being flung round beyond it, and were severely damaged. Thirty-four persons were killed on the spot, another died later, and 179 were injured. Such, briefly, is the story of the accident.

Three features of it are more particularly dealt with by Colonel Mount, namely: the state of the weather, the condition of the distant signal, and the actions of the Castlecary signalman. On the basis of a considerable amount of evidence and information from various sources, he concludes that visibility was probably limited to 400 to 500 yd.; the possibility of the signalman having seen the backlight of the distant signal at the time he said he did is thus called in question, and in any case the light itself was not an accurate guide to the real position of the arm. The signal was an easy working one, however, and seen to be "on" by those on a light engine proceeding to the scene about an hour after the accident. No means exists of proving what the condition of the signal was when the two trains were accepted, let alone when their drivers passed it, and the problem must remain one of the unsolved mysteries of the rail. It is admittedly improbable that two experienced drivers in succession should have missed or misread it, although probably neither was expecting for a moment to be checked at that place at such a time, where a clear run had long been their regular experience. The driver of the Edinburgh express had indeed shown himself vigilant the day before in slowing down for an imperfectly displayed distant signal at Polmont, and Colonel Mount, in the total absence of all proof as to the position of the signal arm—and rightly, in our opinion—gives the drivers the benefit of the doubt. He does, however, hold them responsible to some extent for not observing the spirit of Rule 127 (iv) in regard to cautious driving in adverse weather. Be that as it may, the case emphasises a danger that undoubtedly exists on a scale some are unwilling to admit. Any observant person can see many doubtful distant signals accepted as "off." Some signalmen—we regret to have to say it—are not over careful in observing their signals and repeaters, but

drivers have the remedy in their own hands. They should slow right down every time a distant signal is not fully "off." All distant signals, without exception, certainly on main lines, ought in our opinion to be repeated and proved in conjunction with the block before a train can be accepted. Colonel Mount strongly recommends the early completion of such work on all main lines subject to high speed, and with this we emphatically agree.

Many of the statements made by the Castlecary signalman were contradictory, inaccurate, or otherwise unsatisfactory, and the report characterises his evidence as unreliable. He suggested at one time that the Dundee train must have been propelled back. This having failed to bear examination, he asserted that the track circuit, or at least its indicator, must have failed at "clear." There does not appear to be the slightest ground for either supposition. His failure to see that the track at the starting signal was occupied was a serious one, while his fear that the Edinburgh train might not stop appeared to indicate some doubt about the condition of the signals, which should have been enough to lead him to refuse that train at least until he had news that the Dundee train was safe and well out of the way. His actions are extraordinarily difficult to analyse, and, although his superiors spoke well of him, he could not, in Colonel Mount's opinion, be depended on in an emergency in such a responsible position in a main line box. The stationmaster, too, although a capable official, seems to have involved himself in contradictions, as did other witnesses, such as some of the permanent way men. It is, therefore, not surprising that the trial of the driver of the Edinburgh train on a charge of culpable homicide, the indictment asserting that he had run past his signals, begun on March 30, 1938, should have been withdrawn on the following day.

Colonel Mount deals at some length with the general question of passenger rolling stock construction and its behaviour in collision. As he emphasises, telescoping is the chief danger in such an event, and he commends the policy of the L.N.E.R. in having standardised the use of buckeye couplers and Pullman vestibules for main line stock. Such equipment proved its worth at Castlecary. When a collision occurs, whether it be the everyday collision of a locomotive backing on to its train, or the fortunately rare occurrence such as the collision at Castlecary, the shock must be absorbed, and the principle upon which shock absorbing equipment is designed is the same in every instance. The gentle collision of the locomotive backing on to its train is absorbed by spring buffers without unpleasantness or danger to anyone. Similarly, the best means of catering for an emergency collision of far greater magnitude is to provide the most efficient and powerful type of shock absorber possible in order to minimise damage and risk to life and limb. The parts of the train conveying human beings should be made as strong as circumstances permit, and the shock absorbing equipment should be such as to distribute the impact as nearly instantaneously as possible throughout the whole length of the train. British railway companies judiciously direct their resources and experience both to preventing accidents and to minimising their effects should they occur.

It was, in the circumstances, inevitable that A.T.C. should receive consideration by Colonel Mount, for no conclusion could be arrived at respecting the condition of the distant signal which the two drivers said was "off." The question of repeating and proving has already been mentioned, but, as the report says, the only positive safeguard against such an accident is some form of A.T.C. The subject is, as Colonel Mount puts it, "contentious and difficult," and to harmonise the requirements of 2-aspect signalling areas with those where multiple-aspect signals are used is admittedly not easy. On lines such as the

Southern Railway where multiple-aspect signals are being widely extended, expenditure on them should, in Colonel Mount's opinion, take preference over the application of A.T.C. devices; but on the main line elsewhere, where the older semaphore system will probably long remain but is now being required to deal with much higher speeds, the situation does call for improvement. No doubt colour-light distant signals—or much better lights in distant semaphores—are a step forward of considerable value, but it is, we feel, a mistake to exaggerate the visibility of colour-light units under bad weather or other impeding conditions, as there has been a tendency in some quarters to do. Even with them some form of A.T.C. on the main steam lines is very desirable. Its advantages have been proved on the G.W.R. and we are not surprised to see the L.N.E.R. recommended to come to an early decision on the matter. Colonel Mount suggests the compromise of putting A.T.C. in the 2-aspect areas only, perhaps even confining it at first to the extra high speed trains, but no doubt that could be justified only as a temporary course necessitated by economic considerations. We shall thus expect to hear of important decisions on the matter before long, but whatever is done should be undertaken in harmony with the general trend of signalling development, which is towards the ultimate adoption of track circuiting and automatic signals throughout our main trunk routes. This would make continuous cab signalling possible in the end. The report is the result of one of the most difficult inquiries any inspecting officer can ever have had to conduct. The full document* is very lengthy and detailed, and forms a valuable reference work; on later pages we publish a comprehensive summary.

* * * *

The Belgian National Railways in 1938

The report for 1937 of the Belgian National Railways shows some improvement over the results of the previous year, a shortage of fr. 17½ million in net earnings having been converted into a surplus of 36·8 millions. Nevertheless, the report says, this cannot be considered as satisfactory, and it is a long way from what may be accepted as a solvent position. During the first five years of the company's control, receipts exceeded expenses, but with the beginning of the general depression in 1931 the situation was reversed. In 1937 industrial activity in Belgium exceeded that of 1930 and yet railway receipts were fr. 840 million less, in spite of the increases of tariffs authorised in May and August. This is attributed to the competition of the roads and waterways, which is doubly prejudicial, as not only is tonnage diverted but the railway receipts are diminished by the reductions which have to be made in tariffs. The result is that in spite of the general industrial recovery the railway system closed its year with a deficit, taking into account financial charges, of fr. 28 million. The principal operating figures are as follow:—

	1937	1936
Length of line open, km.	4,844	4,849
Passengers (millions)	202·4	189·5
Goods, tons (millions)	73·1	65·0
Train-kilometres (millions)	86·3	79·2
Ratio of working, per cent.	98·63	100·76
(millions of francs)		
Coaching receipts	837·7	754·8
Goods receipts	1,792·3	1,475·5
Gross receipts	2,688·8	2,287·1
Total expenditure	2,652·0	2,304·6
Net earnings (surplus + or deficit —)	+ 36·8	— 17·5
Deficit after meeting financial charges	28·0	151·3

The total expenditure includes fr. 433 million carried to renewals fund, against 362·3 millions under this head in

* Published by H.M. Stationery Office. 63 pp. and 4 sheets of diagrams. Price 4s. net.

the previous year. This appropriation for renewals accounted for 16.32 per cent. of the whole of the working expenses, while 61.03 per cent. was for salaries and wages, 18.35 per cent. for materials, and 4.30 per cent. for sundries. Pensions, proportionately included in expenditure, amounted to no less than 399.3 millions. The distribution of passengers by classes was 0.2 per cent. first, 6.7 per cent. second, and 93.1 per cent. third, while by receipts the proportions were respectively 1.7 per cent., 17.8 per cent., and 68.5 per cent., with 12 per cent. for workmen's season tickets. Receipts per passenger-kilometre are very low, at 1.39 gold centimes, compared with 2.04 in France (Nord); 2.96 in Germany; 3.53 in Holland; and 4.11 in Switzerland. The average journey was 30.3 kilometres. The average haul of merchandise had risen to 85.2 kilometres, and the average paying load of goods trains to 250.7 tons. Of the gross receipts 31.1 per cent. corresponded to coaching traffic, 66.7 per cent. to goods, and 2.2 per cent. to miscellaneous. The increase of 10.7 per cent. in train-kilometrage was accounted for by the organisation of rapid services at regular hourly intervals between the capital and Liège, Ostend, Mons, and Namur, and augmented schedules on other lines, with a new service for the coal workers in the mining districts. Accident returns showed an average of 23 million journeys for every passenger fatality, and 1.4 million journeys for every passenger injured. Door-to-door goods delivery service was maintained and extended to isolated districts; it is calculated that 70 per cent. of the whole population is now served in this way. Container service has also been further developed.

As regards road services, the company was conceded

16 new motorbus lines in 1937, making a total of 54 lines, or 1,362 km. now worked. Collaboration in through tariffs and services was further extended with the Vicinal railways. The 43 railcars (38 diesel and 5 steam) ran 3,282,742 km. during the year. It was decided to reduce progressively the number of locomotives in service to 2,700 units, which is considered to be sufficient to deal with all future traffic. The number of engines owned at the end of 1936, 3,648, has already been reduced to 3,161. In accordance with the agreement under which the State advanced fr. 55 million for this purpose, certain new works are being undertaken to relieve the unemployment problem. In view of the success of the electrification of the Brussels—Antwerp line, further electrification plans are being studied. The work on the junction line between the North and South stations in Brussels is proceeding. The number of level crossings fitted with luminous and audible warning signals was further increased and 51 crossings were abolished. Finally, the report says that the attention of the Government has had to be called to the serious position of the company. The results for 1937 prove that even in a period of industrial activity the railway system is unable to meet its obligations, and if this is so it means that it cannot long continue to bear the burdens imposed on it by the Statute. It must not be expected to go on carrying gratuitously or at ridiculously low prices, mails, military, and other State transports; it is doubtful to what point it should be liable for pensions earned in part before the company acquired control; and it cannot continue to meet the competition of other more privileged forms of conveyance, for which some form of co-ordination is vitally necessary.

LETTERS TO THE EDITOR

(The Editor is not responsible for the opinions of correspondents)

Tramroad and Tramway

London, E.C.3, June 18

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—On reading your interesting leader on the subject of "Tramroad and Tramway" I was reminded of an early reference clearly supporting your statement that the practice arose of laying along streets parallel lines of stone for the wheels of ordinary carts, which were commonly called tramways. A volume entitled "Roads and Railroads," published in London by John W. Parker in 1839, says:—

Two kinds of pavement are chiefly adopted in the capitals of Great Britain and Ireland; the one is termed the *ruble* causeway, and the other the *aisler* causeway. In the *ruble* form, the stones are slightly dressed with a hammer; in the *aisler* form, the stones are nearly of determinate dimensions, varying from five to seven inches in thickness, from eight to twelve in length, and about a foot in breadth. A good specimen of the *aisler* causeway is to be seen in the Commercial-road, leading from Whitechapel to the India Docks, at Blackwall and Poplar. This road is seventy feet wide, and two miles long. The footpaths are laid with Yorkshire flags, and the roadway with granite. The tramway consists of large blocks of stone, eighteen inches wide by twelve inches deep, and from two-and-a-half to ten feet long; these are placed in rows, four feet apart, on a hard bottom of gravel, or on a concrete foundation; their ends are firmly jointed together, so as to prevent any kind of movement. As an example of the value of this road, it is stated that a loaded wagon, weighing ten tons, was drawn by one horse from the West India Docks, a distance of two miles, with a rise in the road of 1 in 274, at the rate of nearly four miles an hour. Mr. James Walker is the engineer of this fine work.

In the "Penny Cyclopædia" of 1841 it is stated that "a stone tramway was laid on the Commercial Road, London, in March, 1830" but no description of the work is given. "Roads and Railroads" also states (page 89) that in Milan the smooth kind of paving was laid "in two double lines for the wheels of carriages coming and going, and the rougher in the intermediate parts, for the feet of the horses." A

similar form of road was adopted in Maiden Lane, Covent Garden, about 1844, and, when the question of the retention or otherwise of the arrangement arose in 1852, the parallel lines of stone were commonly referred to as a granite tramway, or simply a tramway.

Yours faithfully,
JOHN WELLINGTON WELLS

Poetry-Rhythm-Romance

London, S.W.

June 11

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—The London Midland & Scottish Railway has explored many avenues of locomotive nomenclature, but it cannot have escaped the notice of your readers that the claims of literature, and in particular poetry, have been subordinated to a somewhat prosaic preference for martial and geographical appellations.

In view, therefore, of the attention which has recently been bestowed, in certain sections of the press, on railway rhythm and the glamour thereof, I feel that now is the most suitable time for reviving the cult of naming express locomotives after illustrious versifiers—a sentiment which I am sure would be fully endorsed by L.N.W.R. enthusiasts who can remember the days when Percy Bysshe Shelley, Sir W. S. Gilbert, and Lord Byron, *inter alios*, were in their prime.

Moreover, with the impending centenary of the London & Birmingham Railway, what more entrancing—more romantic—spectacle could gladden the eyes of literary "locomotivites" at Euston and New Street, than that of *Rudyard Kipling* bringing up the 9.15?

Yours, &c.,
LITTÉRATEUR

PUBLICATIONS RECEIVED

Men and Iron: The History of New York Central. By Edward Hungerford. New York: Thomas Y. Crowell Company, 432, Fourth Avenue. 9½ in. by 6½ in. by 1½ in. 424 pp. + 24 full page plates. Price \$3.75.—The late Mr. A. H. Smith, President of the New York Central Railroad, once said: "this railroad is 95 per cent. men and 5 per cent. iron," and this phrase has inspired the title of Mr. Hungerford's volume on the history of the New York Central. The same phrase, moreover, has provided the theme of the book, for the author has given full play to his skill in reconstructing the scenes and personalities which impart life to the background of dates and facts about physical properties which are typified by the "iron" in the partnership. The present New York Central system embraces a wealth of history and tradition. The railroads consolidated into the New York Central Railroad on its formation in 1853, comprised some of the earliest lines in the country, and their importance in the development of the life of the community is made readily apparent by some of the facsimile timetables reproduced. On June 1, 1843, the Superintendent of the Attica & Buffalo Railroad was able to announce proudly on his large timetable sheet that by the chain of railways of which his line formed one, the journey from Buffalo to Albany might be made in 25 hr. Exactly 95 years later the New York Central has just announced the acceleration of its crack trains so that the journey between New York and Chicago from June 15 has taken but 16 hr. for its 958 miles. Apart from such crack trains requiring mile-a-minute schedules, however, the 293½ miles between Buffalo and Albany are now normally covered in about 5½ hr.

That railway publicity was by no means unknown in 1846 is shown by a handbill headed "Eastern Rail Road," also issued by the Attica & Buffalo Company, which boldly announced that it was the "Safest, Cheapest and only expeditious route," and cautioned strangers not to be misled by runners offering tickets about the street corners for old routes that have had their day. It added that no runners were employed by the railroad company to annoy travellers, but trains started precisely at the hours stated. From central New York, Mr. Hungerford takes us through the story of the lines approaching New York City, of which the earliest was the New York & Harlem which began practically as a street tramway on Manhattan Island when it opened the first section of its line in November, 1832. Naturally, the great personality in the establishment of the New York Central as a national system was Cornelius Vanderbilt, and Mr. Hungerford does full justice—even with kindness—to the career of the great Commodore.

The announcement of the publishers states that "Edward Hungerford travels

on an average 50,000 miles a year, and no matter where he goes, he always carries six pairs of glasses with him so that he never misses seeing a single thing." Whatever factual exaggeration this statement may contain there is no doubt that it conveys a substantially accurate impression, for few American writers have combined with such skill as Mr. Hungerford the accuracy of the historian and the interesting style of the popular writer. The volume is well printed, excellently illustrated, and adequately indexed, but its title and dust cover are not such as to create a correct impression in the minds of British readers, who are apt to associate the highly-coloured dust cover and popular title more with a purely popular narrative—perhaps for children—than with a serious work well worthy of its place in any collection of well-known historical volumes.

Official Hand-Book of Stations: 1938 Edition. London: The Railway Clearing House, Seymour Street, N.W.1. 11½ in. × 8 in. × 1½ in. 654 pp. Full cloth cover. Price 10s. 6d. net.—The Railway Clearing House has just produced a new edition of its official hand-book of stations, including junctions, sidings, collieries, works, &c., on the railways in Great Britain and Ireland. The information, which is arranged alphabetically under the station name, includes station accommodation, crane power, the full name of the station, the county in which it is situated, the railway company or companies by which it is served, and its position in relation to adjacent railway points. At the beginning of the volume is a three-page list of railway companies showing the abbreviations of their titles used thereafter throughout the volume. This list includes not only the standard-gauge lines, but also all the goods-carrying light railways with physical connections or exchange sidings that bring them into contact with the main railway system. Thus the Ravenglass & Eskdale and the Romney, Hythe & Dymchurch, both of which are 1 ft. 3 in. gauge lines, duly find their place in the book. Despite grouping in both Great Britain and Eire, there are still certain advantages in knowing on which of the constituent railways a station was formerly situated, and therefore this handbook still indicates in parentheses the particular unit of the main systems, and in some cases even gives a hint of its history. Thus the old Van Railway is represented by the symbols G.W. (Cam.) (Van). Moreover, with joint committees of which both partners are now in one of the group railways, similar distinctions are preserved, and so we have for the Ashby & Nuneaton Joint Railway the abbreviation L.M.S. (A. & N. Jt.) (L.N.W. & Mid.). The volume is, of course, a valuable reference work not only for railway staffs, but also for traders, and all will welcome

the production of a new edition which brings the latest information within the compass of one book and avoids—at any rate, for the time being—the use of a main bound volume, and a supplement in paper covers.

Modern Steels.—Thos. Firth & John Brown Limited, of Sheffield and Scunthorpe, has published a revised edition of *Firth-Brown Steels*, which forms a complete guide to the characteristics and applications of these materials. An illustrated foreword describes the modern equipment and processes of production at the command of the maker, ensuring steels of the highest reliability for modern conditions. Among the grades specifically intended for railway use are special tyre and axle steels. The tyre steels range from a tensile strength of 42-48 tons per sq. in. for low-speed service on heavily loaded wagons, up to much tougher classifications suitable for the driving wheels of express locomotives. For axles, the range of recommended steels embraces certain highly-alloyed oil-hardened and tempered steels of 55-65 tons per sq. in. tensile strength, suitable for working under highly stressed conditions. Numerous other railway and general engineering applications are mentioned in this comprehensive schedule of the standard grades of steel supplied by Thos. Firth & John Brown Limited.

Motors and Starters.—An illustrated catalogue from the General Electric Co. Ltd., Magnet House, Kingsway, W.C.2, contains an abridged list of Witton a.c. and d.c. motors, and of G.E.C. starters for both types. The a.c. machines are of the squirrel-cage, slip-ring, and repulsion induction types, for voltages from 230 to 460. In all machines both a.c. and d.c. (the latter for 220- or 440-V. circuits) ball or roller bearings are fitted. Motors of from 1 to 50 h.p. are shown in the list. Among the starters is a contactor type for squirrel-cage or repulsion-induction motors controlled by "start" and "stop" push-buttons, and other hand-operated types with automatic features. A push-button contactor is also listed for d.c. motors.

Scientific Surface-Hardening.—A selection of machines for the surface-hardening of steel and cast-iron components by the Shorter process is shown in a new illustrated folder from the Shorter Process Co. Ltd., Celtic Works, Savile Street East, Sheffield, 4. The Shorter process comprises scientific heating and quenching of the material being treated under mechanical control, and in the machines illustrated the heat is provided by specially designed oxy-fuel burners, followed by quenching by a jet of water or air. As uniformity in the rate of heating is essential, the machines are produced in a range of types to suit different classes of component. Among those shown in the folder are machines for the hardening of gears, crankshafts, wheels, and tyres.

THE SCRAP HEAP

An English university professor was waiting in the bitter cold for a train to London when the non-stop Cornish express astonishingly stopped at the station. The professor promptly got on board. He had one foot in the carriage when a railway official called out: "You can't get on here, sir. The train does not stop." "That's all right," said the professor. "If it doesn't stop, then I'm not on it."

HOW THE HEN PAID ITS FARE

A white hen, named *Lucky*, belonging to Mr. Woodrow, of the Railway Wharf Inn, Renfrew, has lately taken a great liking for railway travelling, and for some time has been a daily passenger to Paisley. *Lucky* has no money, of course, to pay her fare, but she scorns to impose on the guard. She, therefore, works her passage faithfully, and pays him in kind, by laying him an egg every day she comes to town, an arrangement deemed perfectly satisfactory to both parties.—From the "*Paisley Advertiser*" of May 18, 1838.

What was often called the "Peg Leg Line," with trains that ran on a single rail nailed to post tops, was probably America's only monorail system. It was built in 1877-78 from Bradford in the oil fields of McKean County, Pennsylvania, up the Foster Brook Valley to Gilmore, four miles away, and cost \$30,000. The single rail was spiked to heavy timbers laid along a line of sturdy posts; the cars and locomotives ran on wheels set in line, with overhanging sides to balance the train. A traveller compared it to a gigantic pair of boots swung over a clothes line. It could round corners and climb steep grades at a speed of about 30 m.p.h. Disaster ended the experiment when, on the morning of January 27, 1879, one of the boilers exploded, killing five men and wrecking the train.

EARLY STEEL RAILS

A Vienna paper contains a curious account of the efforts making to advance the internal manufacture of rails. One foundry at Prevali in Carintha is said last year to have furnished 1,500 tons of rails with three furnaces. The fact is, that these rails are of such beautiful steel, for the most part, that they might be cut up into razors and sword-blades, as they are formed of the classical steel, which is as unique in our days as it was in the days of Horace, and for which, if there were but a decent road to Trieste, our cutlers would probably be glad to give more than double the weight of ordinary iron. Of this material the beautiful hanging bridge at Vienna is made, which is suspended upon two main chains instead of the usual four, and which weighs proportionately about two-thirds of the weight of

another suspension bridge at no great distance from it, made of common iron, after a model by Brown.—From "*The Railway Times*" of April 2, 1842.

A ticket collector on a northern railway obtained leave to go and get married. He was given a pass for the journey, there and back. On their return the young man, being rather flurried when asked to show his ticket, produced his marriage certificate instead. The collector, a Scot, looked long at the paper in perplexity, then said: "Eh, mon, you've got a ticket for a lang weary journey, but noo on the Caledonian line."

A boiler failure in the plant of the Harding Cream Company, of Kansas City, Missouri, would have necessitated the closing of the plant for two weeks while repairs were made, had it not been for the co-operation of the Santa Fe Railroad which loaned the firm a locomotive and connected it to the main steam line inside. The action of the railroad was so greatly appreciated that the firm mailed an illustrated circular to all its customers and correspondents recounting the incident. The letter said, in part, "We want everyone to know that the railways not only pay their share of taxes, furnish fine freight and passenger service, but, in this case of emergency, went beyond the line of duty in helping us to keep our butter plant in operation; just another reason why we cannot get along without the railroads."

A LOCOMOTIVE IN DISTRESS

A somewhat ludicrous circumstance occurred on Sunday to a party who had made a trip with an engine and tender, on the Manchester & Birmingham Railway, from this town as far as Crewe. They started early in the afternoon, taking dinner at Crewe; and having enjoyed the creature comforts of this world, they prepared to return in the evening.

They came at a confident speed to Sandbach; but at Holmes Chapel, billy became somewhat uneasy; at Chelford he began to lag; at Alderley he grunted; and near Wilmslow he groaned and made a dead halt! Not a peg would he stir—stupid as a mule. The party in their extremity held a "council," an investigation into billy's grievances and complaints was duly entered into; when lo! and behold! it was discovered that all the water was consumed, and that the vital principle of locomotion on the "rail" was extinct. To get up steam without water was a problem too difficult even for a modern reformer to solve—and they consider themselves no bird's meat. Here then was a regular "fix," as Jonathan would affirm. They waited, in prayer and supplications, the possible arrival of another engine, when towards midnight an engine and tender were despatched hence in the utmost alarm in quest of the distressed *crewesers*, whistling all the way, at the very top of the steam. They were however luckily relieved from their dilemma somehow near Wilmslow without any accident.—From the "*Stockport Advertiser*" of May 12, 1842.

A chain-driven locomotive, which for many years has been used in industrial shunting service at Croydon, is now being broken up.



**MOTHERS LOOK OUT FOR YOUR CHILDREN!
ARTISANS, MECHANICS, CITIZENS!**

When you leave your family in health, must you be hurried home to mourn a

DREADFUL CASUALTY!

PHILADELPHIANS, your RIGHTS are being invaded! regardless of your interests, or the LIVES OF YOUR LITTLE ONES. THE CARDEN AND ARBOY, with the assistance of other companies without a Charter, and in VIOLATION OF LAW, as decreed by your Courts, are laying a

LOCOMOTIVE RAIL ROAD!

Through your most Beautiful Streets, to the RUIN of your TRADE, annihilation of your RIGHTS, and regard less of your PROSPERITY and COMFORT. Will you permit this? or do you consent to be a

SUBURB OF NEW YORK!!

Rails are now being laid on BROAD STREET to CONNECT the TRENTON RAIL ROAD with the WILMINGTON and BALTIMORE ROAD, under the pretences of constructing a City Passenger Railway from the Navy Yard to Fairmount!!! This is done under the auspices of the CARDEN AND ARBOY MONOPOLY!

RALLY PEOPLE in the Majesty of your Strength and forbid THIS

OUTRAGE!

Poster circulated extensively in Philadelphia and the vicinity in 1839. The cut is taken from the Journal of the Franklin Institute for June, 1937

OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

EIRE

Protests Against Rumoured Closing of Railway

In addition to a meeting held at Claremorris on May 30 [as briefly reported in the Notes and News Section of our issue of June 3—Ed. R.G.], others took place at Sligo and Collooney to protest against the rumoured decision to close the Great Southern Railways line between Sligo and Claremorris. At the Sligo meeting a letter from the General Manager was read, stating that it was unlikely that any immediate decision upon the subject would be taken, but that a watch had to be kept upon the volume of traffic on the various branch lines, and that might have given rise to the rumours. Diversion of traffic to the roads necessitated the watch.

One of the arguments voiced at the Claremorris meeting against the closing of the line was that the cost of diverting all traffic to the road would fall on the County Councils and so upon the public. In reply to the accusation that the railway did not put buses and lorries on the road and prevent competition before it arose, Mr. O'Dowd, representing the General Manager, pointed out that the company was not permitted to run road services before the passing of the Transport Act, and that services were now run as public demand for them arose. He also emphasised that road competitors' employees were not subject to minimum wages or working hours as were those of the railway who enjoyed the protection of their unions.

At some meetings of Chambers of Commerce, Town Commissioners and other public bodies, the more common-sense speakers pointed out that while the railways were being asked not to close their branch lines, business was being given to their competitors. One prominent business man in the West stated that the concerns with which he was connected did not run lorries on any route served by the railway, as they realised the use and value of the latter. He urged traders, when protesting, to give the railway something concrete by way of increased traffic.

INDIA

N.W.R. Bridge and Locomotive Rejuvenation

The Victoria Bridge over the Jhelum River on the Malakwal—Kundian section of the North Western Railway is to be strengthened by renewing the 17 spans of 150-ft. girders. Tenders are being called in India for the supply of the steelwork.

The E/1 class Atlantic type locomotives supplied by the North British

Locomotive Co. Ltd. to the Great Indian Peninsula Railway about 1907, and subsequently transferred to the North Western system owing to the main-line electrification on the G.I.P.R., are to be rebuilt at Moghalpura shops after over 30-years' service. Among other works to be carried out upon them are the provision of new frames with horse-shoe horncheeks, and, it is reported, the trailing wheels are to be fitted with roller bearings. It is remarkable that a class of locomotives should be rebuilt after 31 years' service, particularly in India.

BRAZIL

New Engine-stock for the V.F. do Rio Grande do Sul

Four of the Mountain type locomotives together with 300 closed and 100 open wagons ordered in Germany by this railway have already arrived at Santa Maria; the remaining seven locomotives are expected to arrive this month (May). In trial runs between Santa Maria and Pinhal the locomotives are said to have given excellent results.

Central Railway

The celebration of the 80th anniversary of the formation of the Central Railway, on February 20 last, gave rise to the publication of some interesting details, amongst which it is stated that on the same date in 1858 the old "Estrada Dom Pedro II," with its 48 km. of line, was handed over to the Republican Government by the deposed Emperor after whom the railway had taken its name. Prior to this date, from March 29, 1853, when the railway was first opened, trains ran between the stations of Sant'Anna and Queimados, a distance of 32 English miles, and served the intermediate stations known as Campo do Engenho Novo, Cascadura, and Maxambomba. The rolling stock then in traffic consisted of 10 locomotives, 8 first class, 16 second class, and 16 third class passenger coaches in addition to 10 wagons for the transport of merchandise.

Records show that at the end of 1858, 62 km. of line were open for traffic and the number of passenger coaches and goods wagons increased to 40 and 100 respectively. During that year 1,500 tons of merchandise and 115,000 passengers were carried and receipts amounted to 296 contos. This is in striking contrast with statistics for 1937 which show 3,450 km. of line open for traffic, and 677 locomotives, 1,055 passenger coaches and 6,881 goods wagons in service. Goods carried totalled 4,000,000 tons and passengers totalled 110,000,000. The number of stations and halts open is shown as

614, and the average number of trains a day 1,150. The growth of the railway is demonstrated by the following table showing the length of line open to traffic at the end of each ten years:

Year	Km.
1858	60·675
1868	196·610
1878	621·752
1888	888·467
1898	1,228·475
1908	1,863·656
1918	2,402·505
1928	2,900·951
1938	3,450·864

Changes in management have been frequent, no fewer than 36 different personages having held the post of Director General (General Manager).

FRANCE

Another Ten-Mile Extension of Paris Suburban Electrification

Operation of the newly-electrified line from the Luxembourg station in Paris to Palaiseau, a distance of ten miles, and the branch to Sceaux-Robinson has proved very successful since the line was taken over by the Paris Metropolitan Company at the beginning of this year. Frequent and fast services to and from Paris at cheap fares are highly appreciated by residents in the outer suburbs. The steam-operated line from Palaiseau to Saint-Rémy-les-Chevreuse, which runs for a further ten miles through the open country south of Versailles, also acts as a feeder of the Metro. Paris and this charming country district are to be brought into still closer touch by the electrification of this additional ten-mile length of line. The rolling stock will be of the same type as that in use on the Metro line to Palaiseau. The National Railways have already begun the work of electrification.

Parisians, many of whom have now two days' vacation every week-end, flock in thousands to the country south of Paris by the Metro suburban extension with its cheap fares. Robinson, so named from the "Robinson Crusoe" huts built in the branches of the trees, has been famed as a pleasure resort for more than a century. Its dancing saloons and restaurants attract throngs of holiday-makers all through the season. Sceaux and its park, laid out and ornamented by fountains and a "grand canal" in imitation of Versailles by Colbert, the famous Finance Minister of Louis XIV, is another favourite and more peaceful resort. Extensive woods in the neighbourhood are also popular for quiet rambles. When the line to Saint-Rémy-les-Chevreuse is electrified, the Metro rolling stock, already often taxed to the utmost, will require substantial additions to cope with the crowds of holiday-makers.

Busy Year for Metro in 1937

The company's annual report points out that 1937 was a busy year for the Metro. Many new sections of the line in Paris and the inner suburbs were

opened, and inside the city $4\frac{1}{2}$ miles were added to the system, bringing the total to $90\frac{1}{2}$ miles; the addition of 4 miles in the inner suburbs carried the suburban total to $7\frac{1}{2}$ miles. The length of the entire system, exclusive of the outer suburban lines which only came into effective operation by the Metro at the end of last year, is now 98 miles.

The Metro last year also had to deal with the transport of visitors to the exhibition; improvements introduced for this purpose brought good results. Numerous stations were enlarged and extra exits provided. It is estimated that the Metro carried half the visitors to and from the exhibition. Net operating income for 1937 amounted to fr. 61 million, despite unfavourable financial conditions. Operating expenses, in fact, rose from fr. 400 million to fr. 544 million.

Effect of 40-hour Week

This growth in expenditure was due to various causes, including the 40-hr. week, which became effective on April 1, and called for a large increase in staff. Other factors included the general rise of industrial prices as a consequence of the new social laws and the devaluation of the franc, which were reflected in the greatly increased cost of upkeep. Wages also had to be increased twice during the year. Receipts from the ordinary traffic failed to follow the rise in prices, and apart from the exhibition period, the traffic generally showed a decline. The 40-hr. week, which took the form of five days of eight hours each, had an unfavourable influence. This was felt chiefly on Saturdays with fewer people travelling to and from work. To some extent it was also noted on Mondays, when the department stores are closed to comply with the five-eight system, and people are not travelling to do their shopping.

S.N.C.F. Changes

New and repainted rolling stock of the National Railways Company may now be seen bearing the letters "S.N.C.F." (Société National des Chemins de Fer Française). Another change coming into effect is the reduction in the number of free travel permits. The company in a recent notice stated that in the first four months of 1938, it had reduced the number issued by 30 per cent. in comparison with the same period of 1937.

CZECHOSLOVAKIA

Expansion in Railway Traffic

Figures just published by the official Bureau of Statistics for 1937 show that the State Railways registered a substantial expansion in traffic and receipts last year compared with 1936. The number of passengers carried was 267,900,000 compared with 240,900,000 in the preceding year, an increase of over 11 per cent. The quantity of freight carried was 72,500,000 tons

against only 58,200,000 tons in 1936, and 45,700,000 tons in 1933, or 24 per cent. more than in 1936 and 37 per cent. more than in 1933. Receipts in 1937, compared with 1936, and with the crisis year of 1933, were as follow:—

Receipts	1937	1936	1933
	(In millions of crowns)		
Passenger ...	847.7	764.3	743.4
Luggage ...	19.2	16.7	16.4
Express goods	107.4	99.8	88.2
Freight ...	2,669.2	2,166.2	1,796.7
	3,643.5	3,047.0	2,644.7

ARGENTINA

Opening of Congress: Presidential Address

The first session of Congress to be convoked under the presidency of Dr. Roberto M. Ortiz, was opened with customary ceremony on May 11. The major part of the presidential address was devoted to a review of the economic situation of the country, its keynote being the urgent necessity for a prudent restriction of public expenditure in order to enable a balanced budget to be maintained, having regard to the fact that, owing to the partial failure of the crops, the financial prospects of the current year compared very unfavourably with those of 1937.

The Railway Situation

The public works section of the address referred to the difficult situation of the foreign-owned railways, owing to diminished receipts and increasing competition from other forms of transport; but no mention was made of the exchange question, which is the most serious problem confronting the companies, the alleviation of which is entirely in the hands of the Government. The address stated that during the past year 153,159,653 passengers and 48,781,765 tons of goods were carried. Owing to the financial situation, the construction of new lines was completely at a standstill, with the exception of the branch of the Santa Fé Provincial Railway from General Obligado to the River Bermejo, which was in progress.

The State Railways

It was also stated that, during the year 1937, the financial position of the State Railways had still further improved. The gross receipts showed an increase on all the lines, amounting in aggregate to \$62,741,380 paper, as compared with \$61,808,445 in 1936, and \$56,649,288 in 1935. The number of passengers carried during the year was 3,403,041, an increase of 5.14 per cent. The services had been improved by the introduction of diesel railcars, of which 25 were actually in service, with 18 others in reserve. During 1937, 302 km. of new lines had been opened to public service, bringing the total length of the national railway system to 10,266 km. If the Cordoba Central Railway and Rafaela Steam Tramway also were included, the total length of the system was 12,310 km., of which 9,793 km. were metre gauge.

Reference was made to the leasing by the State Railways for a period of four years of the Cordoba Central Railway, pending the sanction by Congress of the purchase of the line; and to the agreement entered into with the Santa Fé Provincial (French) Railway for the use of certain sections of that line for the purpose of forming a connection between the Cordoba Central and Argentine Central Northern (State) lines, thus reducing the cost of transport and avoiding the necessity of expropriating the San Cristobal—Rafaela branch, which had been proposed, as mentioned in THE RAILWAY GAZETTE of March 25 and April 1. These agreements, in conjunction with that made with the Compañía General de Ferrocarriles of the Province of Buenos Aires in February last, provided the State Railways with direct access to the City and Port of Buenos Aires.

Road Construction; also the Railway Pension Act

It was further reported that during the year 1937, some 2,650 km. of national roads and bridges, and 7,747 km. of provincial roads had been constructed. These works are at present financed out of the petrol tax funds, but it was stated that the Government was studying the feasibility of issuing bonds for the works of a permanent character, which would be amortised over a period of years.

It was further announced that certain proposals would be laid before Congress during the present session, for the reform of the Railway Pension Law.

Cordoba Central and Transandine Railways

A message urging Congress to give prompt approval to the measures providing for the purchase by the State of the above railways has been sent to the Chamber of Deputies by the Ministry of Public Works. The Government points out that improvements have already been introduced into the Cordoba Central services, such as the use of diesel railcars on the suburban section, the issue of through tickets to the northern provinces, changes in the timetables, and an increase in the number of trains. The message states, however, that permanent improvements, involving capital outlay, cannot be effected until Congress sanctions the passing of the purchase bill. Moreover, certain deviations of traffic which would be of advantage when the two systems are amalgamated, might be prejudicial to the interests of the State lines when the lease comes to an end, should the private railway not be acquired.

As regards the Transandine line, the Government reports that the preliminary work for its reconstruction will be completed in July next, and it is hoped that the actual work of rebuilding the line will begin in October, in order to take advantage of the summer months.

AN EXHAUST TURBINE LOCOMOTIVE

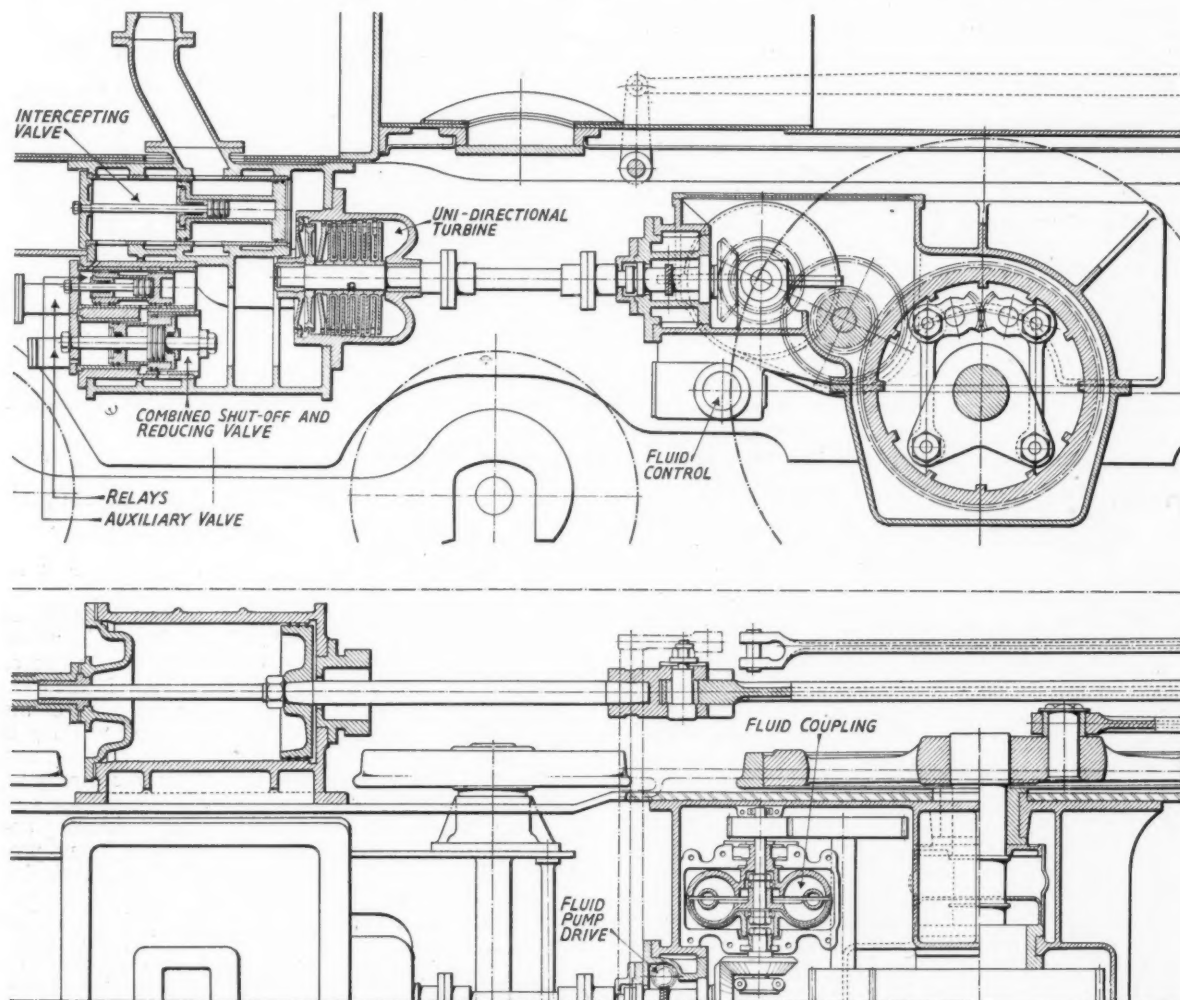
For improving locomotive efficiency a system combining a low-pressure turbine and single-expansion reciprocating cylinders is suggested

By A. REIDINGER, A.M.I.Mech.E.

THE superiority of the reciprocating cylinder for high pressure steam, and that of the turbine for low pressure steam, has been realised in marine practice. The steam, in passing from the low pressure cylinders to the condenser, traverses an exhaust steam turbine coupled to the main shaft through hydraulic couplings, electrically or otherwise, and in this way, a fuel economy ranging from 20 to 25 per cent. has been obtained. In a single-expansion locomotive cutting off at say 20 per cent., the steam exhausts at a considerable pressure; hence there is in locomotive practice a possibility of greater economy than in the case of a triple-expansion marine engine.

A new system applicable to locomotives, and of which details are given below, has been developed and patented

by the author in several countries, and for this it is claimed that the basic drawbacks of ordinary locomotive compounding have been overcome. In this system, an exhaust steam turbine is added as a detachable unit to an orthodox type of locomotive, and is housed in a special design of saddle casting. The drive to one of the coupled axles is taken through hydraulic couplings, and the final gear drive is designed to allow for any relative movement between the engine frame and driving axle, a thoroughly flexible drive being ensured by an intermediate quill shaft. The directional control of the turbine is interlocked with the normal reversing gear and a turbine control in the cab, the latter enabling the driver to have complete control of the entire locomotive combination. By this control the turbine can be cut in and out at any moment and at



Longitudinal section and plan of exhaust turbine, and sections of hydraulic coupling

any speed of the locomotive. Alternatively, the regulator may be closed and the engine run on the turbine only by passing steam direct from the boiler through a reducing valve, or, if it is desired to get the maximum power out of the locomotive, both the turbine and the cylinders may be operated by steam direct from the boiler, so that they work as separate driving units.

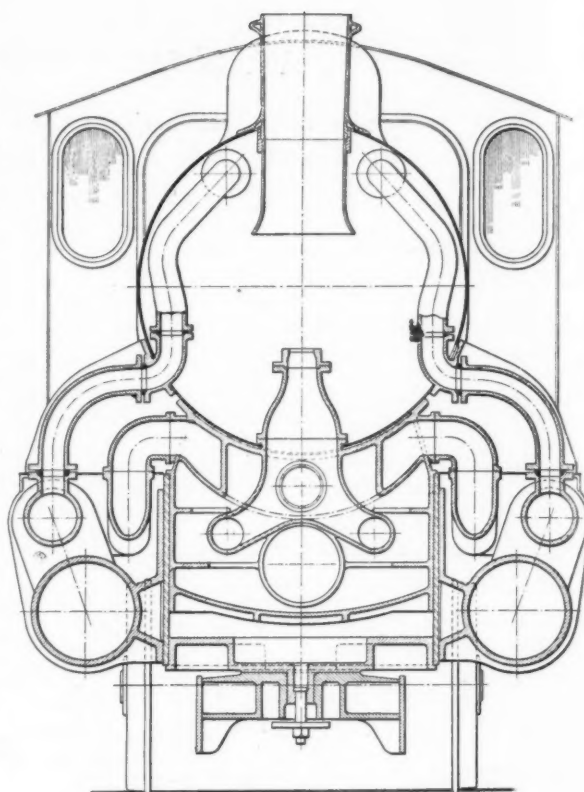
The driver's control in the cab consists of a series of cam-controlled steam and exhaust valves, manually operated, for controlling the intercepting valve, auxiliary valve, combined stop and reducing valve, and hydraulic couplings, through the medium of steam-actuated relay or pilot valves.

The function of the intercepting valve is to pass the exhaust steam from the cylinders to either the receiver or the blast pipe, whereas the auxiliary valve serves to supply steam at boiler pressure to the reducing valve from a source either before or after the regulator, so as to enable the turbine to be run if desired when the regulator is closed.

The combined stop and reducing valve fulfils two requirements, and is accordingly made in two parts. One requirement is to supply live steam from the auxiliary to the receiver at a constant pre-determined pressure, thus functioning as a reducing valve, and the other is to act as a stop valve to close the reducing valve, thus preventing live steam from entering the receiver.

The automatic direction control is desirable to prevent the turbine from working in the opposite direction to the cylinder. In some cases, it may be considered sufficient to use the turbine for ahead running only, the cylinders alone being employed for backward running. In this case only one hydraulic coupling would be necessary with an attendant simplification of the control mechanism both for the turbine and the hydraulic portion of the system, but if the turbine is intended to work with the cylinders for backward as well as forward running, it is necessary to have two hydraulic couplings.

By the latter arrangement of fluid connection, it is made possible for one turbine to drive in either direction, and no reverse turbine is required. The uni-directional turbine operating with fluid couplings overcomes two major objections advanced against turbine locomotives from the



Cross section through smokebox and cylinders

mechanical aspect, involving complication and high first cost, namely moving gears and a reverse turbine and its gearing. The reliability and efficiency of hydraulic couplings for the transmission of powers of considerable magnitude is well established.

Improving the Gotthard Route

THE Gotthard line of the Swiss Federal Railways is part of one of the most important international routes in Europe, and carries a large though fluctuating number of heavy through trains conveying foodstuffs, coal, iron, and other commodities. At times the peak traffic reaches 50 per cent. above the normal. Although a double line throughout is almost essential, many sections of single line remain and make the operation of trains a matter of some difficulty at certain seasons. For some time past the Swiss Federal Railways have been making improvements to the line and sections associated therewith. The line between Emmenbrücke and Sentimatt is being doubled and will be ready in 1939, while plans are agreed on for doubling between Brunnen and Flüelen, and between Rivera and Lugano. Nevertheless some considerable time must elapse, even if funds are available, before all the desired facilities can be provided.

The present single line between the Swiss Federal and Reichsbahn stations at Basle is to be doubled and funds have been allocated to the work. This will considerably improve the operation of certain trains. Improvements have been made to the path of the existing connection with the rest of the system at Lucerne, as well as to the tracks at that station, in order to avoid unnecessary fouling

of lines by certain train movements. A number of signalling improvements have been made, including semi-automatic intermediate signalling in the St. Gotthard tunnel, controlled by axle-counting apparatus, and an intermediate block post between Zug and Walchwil.

On the existing single-line sections from Brunnen to Flüelen, Rivera to Lugano, and Melide to Maroggia, where lock-and-block is worked, modifications in the method of regulating the crossing of trains have been introduced, following their successful adoption on other parts of the system, whereby the responsibility for proper working is placed on the staff at the stations and written orders eliminated. Far fewer stops, with their accompanying expense, are now needed. The turnouts at loops are also being reconstructed to allow of the speed limit being appreciably raised, brake testing stations are being provided with light signals, lock-and-block is further replacing telegraph block, and, by saving a few minutes here and there, a noticeable improvement in the service is looked for. Nevertheless it is realised that a double line throughout is a necessity if the problems facing the management on this route are to be solved in a permanently satisfactory manner. An outline of the historical development of the Gotthard route appeared in our issue of March 25.

BRIDGE STRENGTHENING BY WELDING IN THE SUDAN

*Economically strengthening 66 girder spans on the Sudan Railways**

A NUMBER of N type bridges of 105 ft. span, of weak design for the increased axle loads now required to be run on the Sudan Railways, and which, in addition had suffered corrosion, have recently been strengthened by electrically welding to the top of the top boom, an additional $\frac{1}{2}$ -in. plate 15 in. wide. A contract for thus strengthening 59 spans on the line between Port Sudan on the Red Sea and Atbara on the Nile was awarded to Dorman, Long & Co. Ltd., and as the work was completed two months ahead of schedule, a further seven spans on the branch to Suakin were undertaken, the total of 66 spans being completed in approximately six months.

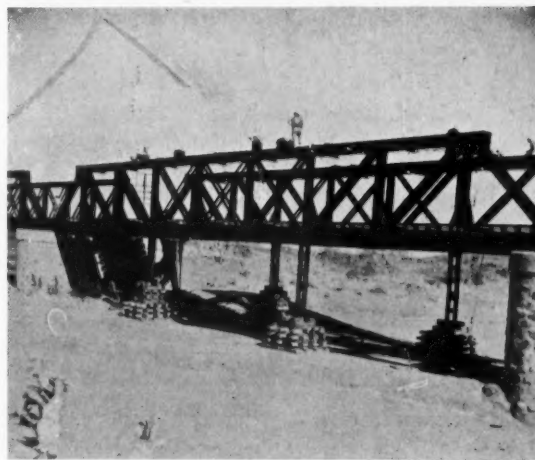


General view of welding in progress

The work was greatly facilitated by the fact that the new plate could be welded to the top boom without interfering with any rivets except the 144 in the cover plates, which were cut out and replaced by countersunk rivets. To relieve the top booms of stress, four jacking posts were erected under each span at least seven days before welding. By this means the girders were jacked up a $\frac{1}{4}$ in. at one-third of the span. This work was facilitated by the fact that the headroom between the river bed and the bottom of the lower boom never exceeded 12 ft., except in the case of one span where it was 23 ft. The absence of any water in the river beds during the period of the welding was also an important advantage.

The welding party consisted of five British welders, each attended by a native labourer and supervised by a British foreman welder. They were able to work from staging suspended from the top boom on the outside of the bridge, and it was thus possible to keep all the plant and staging clear of the structure gauge. During the passage of trains, which were restricted to 5 km.p.h., welding ceased and was not begun again until the $\frac{1}{4}$ -in. lift at the one-third span points had been checked and adjusted if necessary.

Normally the average length of fillet run by one welder was 20 ft. in an hour. The average time taken to clean, set, clamp, and weld the plates was 13 hours a span,



View showing jacking posts and staging for welders

Particulars of the fillet welds were as follow :—

Sizes of Fillets	No. and Gauge of Electrodes	Order of Runs
$\frac{1}{4}$ in.	1 No. 6 gauge	One run
$\frac{3}{8}$ in.	1 No. 10 gauge	1st run 2nd run
$\frac{1}{2}$ in.	1 No. 10 gauge 1 No. 6 gauge 1 No. 6 gauge	1st run 2nd run 3rd run

and the whole work was carried out at an average rate of three spans a week, though this entailed working seven



New strengthening plates being welded

* The particulars given in this article are extracted from an article by Mr. J. S. Pettigrew, District Engineer, Sudan Railways, in *Electric Welding*



Left : Additional plates welded and rivets in old cover plate countersunk ready for an extra plate to be welded on



Right : The finished work

days a week and a certain amount of overtime. Deflection tests were made on one span before and after the welding, and a comparison of readings obtained verified that the object of the work had been attained.

The plant included four portable Mawdsley generators with Lister three-cylinder 27-h.p. diesel engines; 25-ton Duff jacks; special jacking posts which could be quickly assembled to any required length by bolting; field forges;

and a field telephone. In addition a special train was provided by the Sudan Railways when required consisting of three 1,500 gallon water tanks; three 30-ton flat trucks; two 30-ton open trucks, and two 30-ton covered trucks. A first class coach and two saloons were also provided for the contractor's British staff, which was in charge of an agent, and a motor trolley to bring them to their work from the station at which their coaches were standing. The work was supervised by a Resident Engineer representing Mr. H. D. Bindley, Chief Engineer of the Sudan Railways.

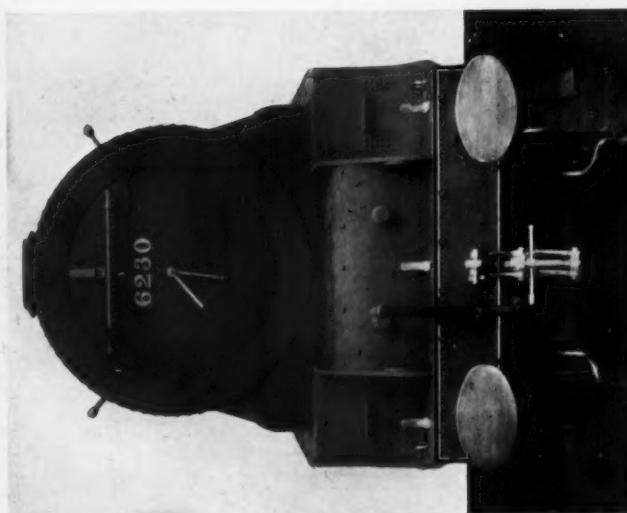
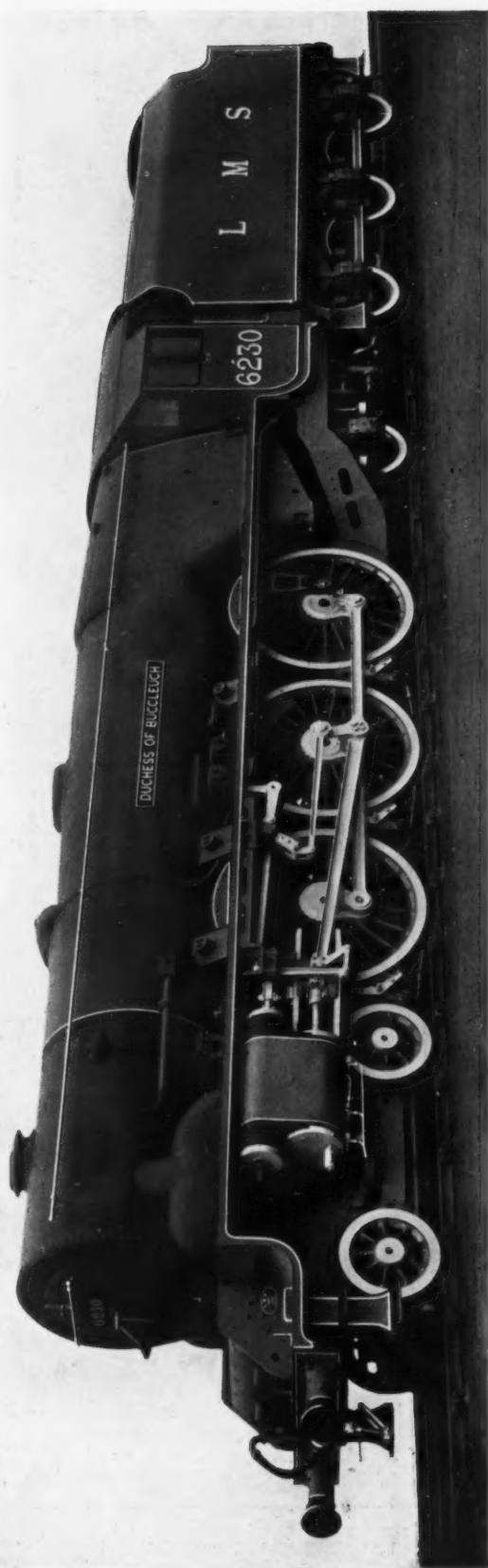


Above : General view of the imposing structure 75 ft. high which houses the office, dominates the whole fair, and is directly approached from all three entrances to the ground. The three façades are treated in different colours, the letters B.B.C.I.R., in red, blue, and green neon lighting, are visible from most parts of the fair. One enquiry counter matches each of these signs

Right : The green counter, with posters depicting the Flying Ranee and Frontier Mail expresses, and executed in oils. The red counter and display similarly calls attention to cheap Easter concessions and Bassein fort, and the blue advertises Kashmir and Mount Abu

B.B. & C.I.R. ENQUIRY OFFICE AT FOURTH INDIAN INDUSTRIES FAIR, BOMBAY





IN our issue of June 10, we described and illustrated one of the new series of streamlined express engines of the London Midland & Scottish Railway, recently constructed at Crewe. As then stated, five further locomotives of the same general pattern, but without streamlining, were being built, and of these, by the courtesy of Mr. W. A. Stanier, Chief Mechanical Engineer, we are able to illustrate the first to be completed—No. 6230, *Duchess of Buccleuch*.

The front of the cab in these engines is projected, the projection enclosing the pop safety valves. The bulbous casing at the front end, alongside the smokebox on each side, is a covering for the steam pipes, which branch in two directions.

In the last engine of the series, No. 6234, *Duchess of Abercorn*, the port passages between the cylinders and the steamchests are streamlined, in addition to the exhaust passages and the piston valve heads. This engine will also be fitted with a hopper ashpan and drop fire-grate for experimental purposes.

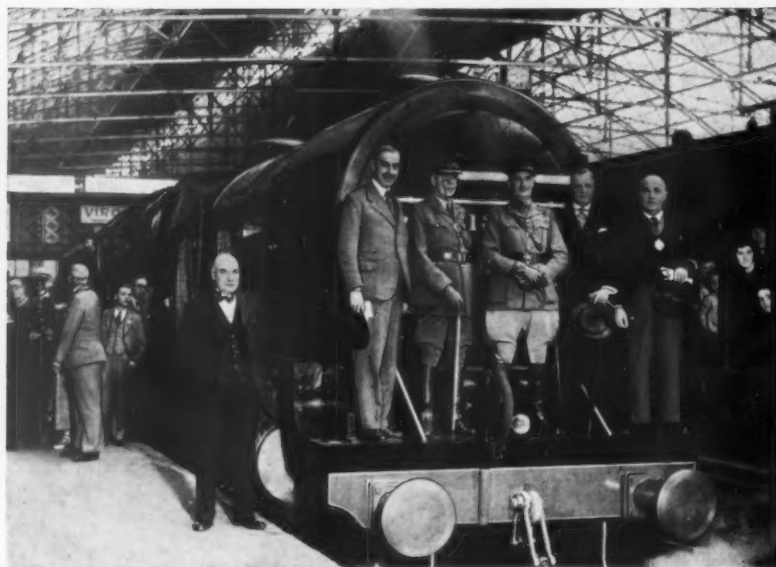
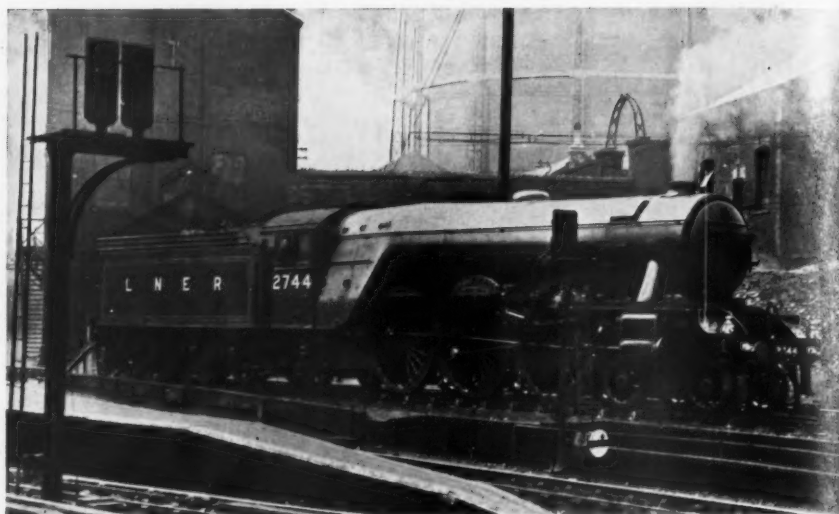
For the convenience of readers, we repeat below the principal dimensions of the class:—

Cylinders (4)	..	..	16½ in. dia. x 28 in. stroke.
Boiler pressure	..	..	250 lb. per sq. in.
Driving wheels, dia.	..	..	6 ft. 9 in.
Total evaporative heating surface	..	..	2,807.5 sq. ft.
Superheater	..	..	856.0 "
Combined heating surfaces	..	..	3,663.5 "
Grate area	..	..	50.0 "
Tractive effort at 85 per cent. b.p.	..	..	40,000 lb.

General and Front End Views of New Non-Streamlined 4-6-2 type Express Locomotive, L.M.S.R.

Right: L.N.E.R. class "A3" Pacific No. 2744, "Grand Parade," at King's Cross on her first appearance after rebuilding, following the Castlecary accident

(See accident report, pp. 1207-12)



Left: Group after naming ceremony at Birmingham of Engine No. 6131 "Royal Warwickshire Regiment," L.M.S.R.

Left to right: Mr. G. R. Bradbury, District Passenger Manager, Birmingham, L.M.S.R., Mr. W. A. Stanier, Chief Mechanical Engineer, L.M.S.R., Brig.-General Sir Walter Ludlow, Brig.-General C. T. Tomes, Lt.-Colonel P. M. Brooke-Hitching, and the Lord Mayor of Birmingham (Councillor E. R. Canning)

(See report on page 1214)

Photo by]

[Birmingham Post

Right: The new L.M.S.R. luxury passenger motor vessel "Swan," for service on Lake Windermere. The launching of this vessel, which is a sister of the "Teal," was recorded on page 1185 of our June 17 issue



Photo by]

[Sankeys

RAILWAY NEWS SECTION

PERSONAL

Sir Alexander Gibb, G.B.E., F.R.S., M.I.Mech.E., M.Inst.C.E., M.I.Chem.E., M.J.Inst.E., M.Inst.T., F.Inst.F., &c., of Queen Anne's Lodge, Westminster, S.W.1, has been elected Chairman of the Association of Consulting Engineers for the year 1938-39.

Mr. W. E. G. Bender, C.I.E., M.B.E., V.D., M.Inst.C.E., A.C.G.I., Chief Engineer of the Bengal & North

way from Samarra to Baiji, 60 miles of standard gauge line, which, including its survey, was completed in 19 working weeks. He was mentioned in despatches and awarded the M.B.E. (Military) in 1919. In 1934, as Chief Engineer of the B. & N.W.R., Mr. Bender was responsible for the rapid restoration of railway communications in Northern Bihar after the great earthquake of January 15, when 533 miles of railway (including about 400 bridges of all sizes) were almost completely wrecked, all except 30 miles of which

Mr. Pearson was appointed Manager of the Locomotive, Carriage, and Wagon Works of the South Eastern & Chatham at Ashford, and on the formation of the Southern Railway was appointed Assistant Mechanical Engineer, while still remaining at Ashford.

Mr. Walter Enves, who, as recorded in our issue of June 17, has retired from the position of Stationmaster, Victoria, Southern Railway, began his railway career with the former London Brighton & South Coast Railway as



Mr. W. E. G. Bender, C.I.E., M.B.E.

Chief Engineer, appointed Acting Agent, B. & N.W. and R. & K.R. (India)



Mr. G. H. Pearson

Assistant Mechanical Engineer and Works Manager, Ashford, Southern Railway, 1923-38



Mr. Walter Enves, M.B.E.

Stationmaster, Victoria, Southern Railway, 1933-38

Western and Rohilkund & Kumaon Railways, who, as announced in our issue of May 20 has been appointed to act as Agent of those systems, was born in January, 1885. He was educated at Dulwich College and at the City & Guilds Central Technical College, South Kensington, where he graduated as A.C.G.I. in 1903; during the two following years he was an Assistant with Messrs. Rendel & Robertson (now Rendel, Palmer, & Tritton), Consulting Engineers, Westminster. Mr. Bender joined the B. & N.W.R. in 1905, and was employed as Assistant Engineer and Resident Engineer, chiefly on new construction work. In 1920 he was appointed Personal Assistant to the Agent, B. & N.W.R., and in March, 1933, was promoted to be Chief Engineer, B. & N.W. and R. & K. Railways. During the war he obtained a commission in the Indian Army Reserve of Officers, saw service on the North West Frontier and in Mesopotamia, and attained the rank of Captain. In 1918 he was in charge of the construction of the extension of the original Baghdad Rail-

way was reopened to traffic by the end of April, 1934, and the remainder by the end of that year. Mr. Bender received the title of C.I.E., in the 1936 New Year Honours. He is a Member of the Institution of Civil Engineers, London, and holds the rank of Major in the Auxiliary Force, India.

Mr. G. H. Pearson, who, as recorded in our issue of June 17, has retired from the position of Assistant Mechanical Engineer and Works Manager, Ashford, Southern Railway, obtained his early experience on the Great Western Railway, entering the Locomotive Works at Swindon as a premium apprentice in 1892. While serving his apprenticeship, Mr. Pearson attended a two-year course in the Engineering Department of University College, London. Having completed his apprenticeship, Mr. Pearson was engaged in the test house, drawing office, and as an Inspector of Materials at Swindon, afterwards being appointed a Junior Assistant Manager in the Locomotive Works, later becoming Chief Assistant Manager in the Carriage, Wagon, and Timber Department at Swindon. In February, 1914,

a probationer clerk at Angmering, and was subsequently booking clerk at Lancing, St. Leonards Marina, Hassocks, Arundel, and Lewes; and Chief Booking Clerk at Hastings until 1907. Promotion to the position of Relief Stationmaster in the London District followed, and he was later appointed to the District Superintendent's staff at East Croydon, and subsequently to the personal staff of Mr. Finlay Scott, the then Superintendent of the Line at London Bridge, remaining there until the amalgamation of the railways in 1923. Mr. Enves then reverted to the position of Stationmaster, filling that position at Surbiton, Bournemouth Central, and Bournemouth West, returning to London Bridge in 1927. He was appointed Stationmaster at Victoria in 1933. Mr. Enves received the M.B.E. in the Coronation Honours of 1937, and the decoration of Chevalier of the Order of Leopold II from King Leopold of the Belgians in November last year.

From *The London Gazette* of June 17: Territorial Army, Royal Engineers, Engineer and Railway Staff

Corps: Lt.-Colonel C. R. Byrom, O.B.E., resigns his commission and retains his rank with permission to wear the prescribed uniform (June 18).

Mr. W. B. Dawson, Chief Superintendent of Transportation, Rhodesia Railways, has been granted six months' leave. Mr. J. Hopwood, Operating Superintendent, has been appointed to act as Chief Superintendent during Mr. Dawson's absence.

Mr. E. M. Rice, Chief Engineer, Rhodesia Railways, has been granted six months' leave, and is visiting England.

The late Mr. S. J. Sarjant, a former Locomotive, Carriage, and Wagon Superintendent of the Great Indian Peninsula Railway, whose death early this year was recorded in our issue of March 11, left estate valued at £17,391 (£17,332 net).

Mr. A. H. Peppercorn, who, as recorded in our issue of June 17, has succeeded Mr. E. Thompson as Mechanical Engineer, North Eastern Area, L.N.E.R., entered the service of the Great Northern Railway as a premium apprentice under Sir Nigel (then Mr.) Gresley, in the locomotive works, Doncaster, in 1905. On the completion of his apprenticeship, he gained experience in the running sheds at Colwick, and was afterwards appointed an assistant to the District Locomotive Superintendent, first at Ardsley, and then at Peterborough. During the war he served in the C.M.E. Department of the Royal Engineers in France, and on demobilisation was appointed District Locomotive Superintendent at Retford, and later served at Doncaster as Assistant in charge of the wagon shops. In 1921 Mr. Peppercorn was appointed Assistant to the Carriage and Wagon Superintendent at Doncaster, and on the amalgamation in 1923 was made Carriage Works Manager at Doncaster, L.N.E.R. In 1927 he was promoted to be Carriage



Mr. A. H. Peppercorn

Appointed Mechanical Engineer, North-Eastern Area, L.N.E.R. [Darlinton]

and Wagon Works Manager at York, and in 1933 was appointed Assistant Mechanical Engineer, Stratford. Mr. Peppercorn was appointed Locomotive Running Superintendent, Southern Area, last year, and this position he now vacates to take up his new appointment.

We regret to announce the death in Buenos Aires, on May 10, of Señor Alejandro Felix Lértora, formerly General Manager and later Legal Representative of the Buenos Ayres Western Railway. Born in Buenos Aires, he began his career in 1877 with the Province of Buenos Aires Railway, then under Government management. After serving in the General Manager's Office, he was transferred to the Accountant's Department, and later became Sub-Accountant. He subsequently served in the Traffic and Stores Departments, and in due

course became Traffic Manager, retaining this position when the Province of B.A. Railway was merged in the Western Railway in 1890. In 1902, Señor Lértora was appointed General Manager, in succession to Mr. David Simson, and on the retirement in October, 1915, of the Legal Representative of the company, Mr. Santiago Brian, Mr. Lértora was nominated his successor. He retired in July, 1927, shortly after completing 50 years of continuous railway service.

Dr. C. H. Dix-Hart, M.B., Ch.B., D.P.H., M.R.C.S., L.R.C.P., Railway Medical Officer, Bulawayo, has been appointed Principal Medical Officer of the Rhodesia Railways in succession to Dr. A. W. May.

The late Sir Leonard Cohen, K.C.V.O., a Director of the Bengal & North-Western and the Rohilkund & Kumaon Railways, whose death on April 10 was recorded in our issue of April 22, left estate valued at £299,169 (£250,683 net).

INDIAN RAILWAY STAFF CHANGES

Mr. A. G. T. Glaisby has been confirmed as Deputy Agent, Works, G.I.P.R.

Mr. B. Moody, V.D., has been confirmed as Chief Operating Superintendent, N.W.R.

Mr. L. N. Flatt has been confirmed as Chief Mechanical Engineer, N.W.R.

Mr. A. Cornish, Officiating Chief Mechanical Engineer, has been confirmed as Superintendent of Mechanical Workshops, N.W.R.

Mr. R. H. Paterson has been appointed to officiate as Deputy Controller of Stores, N.W.R., as from April 19.

Mr. A. J. Cracknell has been confirmed as Deputy Chief Mechanical Engineer, G.I.P.R.

Mr. C. M. Cock has been appointed to officiate as Traction Superintendent, G.I.P.R., as from April 19.



Members of the Institution of Railway Signal Engineers, and their ladies, visiting Wells during their summer meeting at Bristol (see report on page 1213)

[Photo]

[Phillips Studios, Wells]

MINISTRY OF TRANSPORT ACCIDENT REPORT

Castlecary, L.N.E.R., December 10, 1937

At 4.37½ p.m. on December 10, 1937, the 2.0 p.m. express, Dundee to Glasgow, consisting of seven eight-wheeled bogie vehicles and fish van in rear, drawn by Class "D 29" 4-4-0 locomotive No. 9896, *Dandie Dinmont*, while standing at Castlecary station after over-running the down home signal, was run into in rear at about 60 m.p.h. by the 4.3 p.m. Edinburgh to Glasgow express, which also overran that signal and consisted of nine eight-wheeled bogie vehicles drawn by Class "A3" 4-6-2 locomotive No. 2744, *Grand Parade*. A red hand signal was shown to both trains by the signalman. The momentum of the colliding train was estimated at 54,000 ft.-tons. All bogie vehicles had heavy steel underframes of modern construction, except the second and fifth of the Dundee train, and teak bodies, Pullman vestibules, buckeye couplers, and electric light. Screw couplings were in use between the engine and leading coach in each train; the fish van was similarly coupled. The reason for the signals being against the Dundee train was that the failure to clear snow from between the blades of certain facing points at Gartshore, 5½ miles ahead, had held up a preceding Cadder goods train at Dullatur East, the next signal box towards Glasgow.

The effects of the collision were extremely destructive. The three rear vehicles of the standing train were destroyed practically beyond recognition. The engine of the Edinburgh train came to rest 96 yd. beyond the point of collision, derailed and embedded in the cutting side, and was over-ridden by the following three vehicles, the first two of which

were flung round transversally beyond it, and the last came to rest above it. The screw coupling between the tender and first coach held long enough to lap the leading end of the underframe completely back for about 12 ft.

Considerable other damage was done but no fire occurred. Six coach bodies and that of the fish van were burned in clearing the wreckage. Assistance was promptly called and efficiently rendered by railwaymen, police, local workers and others; 28 doctors attended. Of the total of nearly 320 persons on the two trains, 34 passengers were killed instantaneously and one died in hospital; and 179 were injured or complained of shock. The driver of the Dundee train received severe injuries. The weather was cold, with snow falling, and the sun had set an hour before. The line remained blocked until 1.30 a.m. on December 13. The case was investigated by Lieut.-Colonel A. H. L. Mount, Chief Inspecting Officer, Railways, on behalf of the Ministry of Transport.

This section of line is worked by three-position block telegraph instruments, as standard on the former North British Railway, without signal lever control. The down distant signal has no repeater. It was a lower quadrant old N.B.R. type arm on a 30-ft. lattice post; the run of wire was straight and the fittings all in good order. The backlight blinder did not begin to cover the backlight lens until the arm had fallen by 16 deg., nor cover it fully until it had fallen 29½ deg. The full "off" position was 48½ deg. As the goods shed obscured the view of the down platform line from the lever frame, a track circuit was provided from



Third coach of Edinburgh express resting on top of engine and tender. The first and second coaches were ahead as shown in the plan on page 1210. Debris in foreground had already been cleared [Scottish Pictorial Press]

Photo]



Left : Buckled underframe assumed to be that of last bogie coach in Dundee train. Right : A damaged bogie

a point 18 yd. beyond the down starting signal to one 338 yd. in rear. With this exception the view from the signal box is excellent.

The Rules concerned in the circumstances of this accident were Nos. 65, 81, 82, 95, and 127, with relevant instructions in the Appendix dated March 1, 1937, to the Rules and to the L.N.E.R. working timetables. Mr. R. Gardiner, Superintendent, Southern Scottish Area, said that inability to see the arm or backlight of a non-repeated distant signal was considered to be covered by the words "or of the temporary absence of such a signal" in clause (h) of rule 81; to bring his area into line with the rest of the railway the old clause 4 (b3) of the former N.B.R. Appendix was now omitted. This read:—

In all cases where the signalmen are not perfectly satisfied that their distant signal arms are going properly to danger, no train must be accepted from the box in the rear until it has been offered to and accepted by the box in advance.

Owing to the part imputed to the weather, a report regarding meteorological conditions in the district from December 6 to 10 was obtained from Dr. A. H. R. Goldie, Superintendent of the Meteorological Office at Edinburgh. No fewer than 34 witnesses gave evidence about weather and visibility conditions. This was very contradictory. A ganger, some lengthmen, and a lookout-man implied that the visibility was fairly good and there was very little or no snow during the hour or so preceding the accident. One said he could see the down distant at "caution" from a bridge 943 yd. in rear. A signal fitter, who passed Castlecary on

an engine at 3.41 p.m., said it was snowing heavily. Driver J. Cairns, of the 3.41 p.m. Polmont to Glasgow, which stopped at Castlecary at 3.59 p.m., said it snowed heavily all the way; he could not recall a worse evening and thought he saw only one signal light. His fireman confirmed this. Driver W. McDonald worked the Cadder goods train which passed Castlecary at 4.9 p.m. It was snowing all the way. The Castlecary signals were "off." Only the arms, white with snow, were viewed at close range. No lights were seen. Fireman Smith and Guard Penny supported him. Driver Macaulay, of the Dundee express, said the weather was very



Above : Underframe of leading coach of Edinburgh express, buckled back owing to delayed breaking of coupling



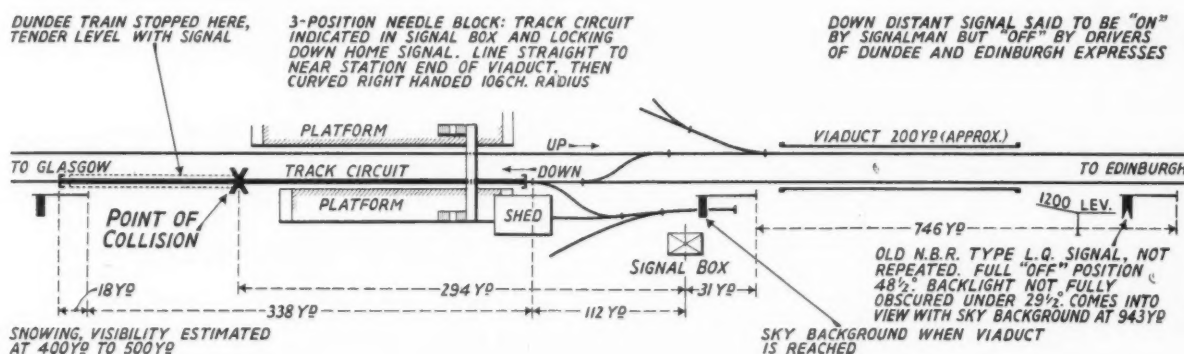
Left : Tender of Edinburgh express locomotive over which the leading three coaches ran

bad. It was snowing at Thornton, and badly at Falkirk and Greenhill. He saw Castlecary distant "off" over the cab side, and the signalman's red lamp when half way over the viaduct; he then came inside and applied the brakes. He missed the home signal and stopped with the tender at the starting signal, from which position he did not move. His fireman confirmed his evidence. Stationmaster Scott, Castlecary, said the snow was not heavy except between 3 and 4 p.m. He was satisfied that fogmen were not required. Ganger Bell assured him at 4.20 p.m. that all signals were working properly. It was then snowing slightly.

Signalman A. Sneddon, Castlecary, affirmed that although snow was blowing on the east windows of the box, he saw the down distant arm return to "caution" at 4.9 p.m. behind the Cadder goods train, and observed the backlight at 4.22 p.m. when he accepted the Dundee train. The worst snow was between 2.30 and 3.20 p.m., but he could see all his signals. Had he not seen the distant he would have had the train stopped at the box in rear. The signal was working perfectly. It was snowing heavily at 3.0 p.m., but

accident when Sneddon accepted the Dundee train. It seems very doubtful whether range of visibility on that day in the open—not through windows—say between 3.30 and 5.0 p.m. reliably exceeded 400 to 500 yd.; the distant signal was 777 yd. from the box.

The evidence regarding the stopping of the Dundee and acceptance of the Edinburgh train is somewhat involved and conflicting. Signalman Sneddon accepted the former train at 4.22 p.m. and received "entering section" from Greenhill Junction 6 min. later. He had, he asserted, seen his down distant go to caution behind the Cadder goods train, which was still in section to Dullatur East, and saw its backlight at 4.22 p.m., but only after going through the act of accepting on the block instrument. He also saw the signal as the Dundee train was approaching; he could see the engine was steaming and not going to stop, so exhibited his red lamp and blew a whistle at the driver. Sneddon also said he saw the backlight again at 4.32 p.m., when accepting the second express, but this was in opposition to his conversation with the company's District Inspector, Mr. E.



Line diagram of Castlecary station, L.N.E.R., showing site of collision and other essential details

there was an abatement for at least 45 min. before the accident.

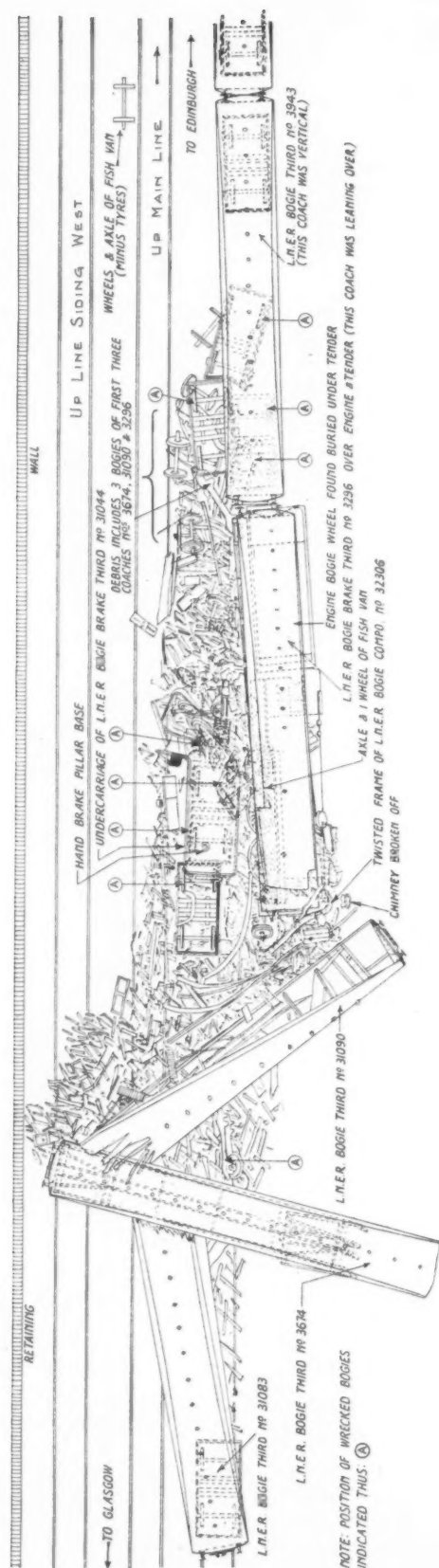
Signalman G. Beattie, Greenhill Junction, the next box to Castlecary towards Edinburgh, said there was practically no snow at 4.30 p.m.; he could see lights $\frac{1}{2}$ mile east and $\frac{1}{4}$ mile west. Driver D. Anderson, of the Edinburgh express, said it was snowing fairly heavily approaching Castlecary, and dark with no moon. He estimated that he observed the down distant, distinctly and properly clear, at 50 to 100 yd. He did not see the home because he changed his glance to the signalman's red lamp on the ground and a detonator was then exploded. He applied the brake, closed the regulator and opened sanders but had no time to move the reversing gear. He saw the tail lamp of the Dundee train on approaching the end of the platform and shouted to his fireman to hold on. It is to be noted that neither this fireman nor that of the Dundee train could testify as to the condition of the distant signal.

Mr. G. S. Inglis, District Engineer at Carlisle, L.N.E.R., a passenger in the restaurant car of the Edinburgh train, could not really speak about range of visibility, but said the snow flakes were such that he was prepared to believe it much less than $\frac{1}{2}$ mile. An inspector travelling on a light engine from Polmont, arriving on the scene at 5.40 p.m., said snow blinded the view of the signals and prevented seeing lights until close to them. The Castlecary distant was seen only when they were close to it; it was undoubtedly in the horizontal position. Others confirmed this. Colonel Mount himself visited the signal box on December 16 to investigate visibility when darkness was falling; at one period neither he nor Signalman G. Preston—three years in the box—could see the arm or backlight of the down distant, although conditions were perfect.

The report concludes that both arm and light were probably invisible from the box at 4.22 p.m. on the day of the

Cunningham. However, he maintained that having already seen it "on" and not having moved it there was no real need for him to have seen it again at 4.32 p.m. He did not watch the track indicator as the train was passing. He had no whistle acknowledgment from the driver, saw the tail light to about the middle of the platform, and gave the 4-5-5 bell signal to Dullatur East. He did not look out of the window after the train, as he thought it had gone right on and that there would be a collision with the Cadder goods, but he admitted that he must have seen it had he looked. He then sent for the Stationmaster. Noticing the track indicator clear he telephoned to Greenhill Junction and conferred about the position with Signalman Beattie, who asked him if he had sent the emergency signal to Dullatur East, had got the requisite clearance beyond the home signal, had seen the tail lamp, and was sure all his signals were "on"; to which he replied "yes"; Beattie said there was no rule to prevent acceptance of the Edinburgh train but advised placing detonators as a precaution. Sneddon thereupon cleared back for the Dundee train and took the Edinburgh at 4.32 p.m., asserting he was anxious to avoid delaying the latter.

It should be noted that the Cadder goods train was stopped at Dullatur East at 4.14 p.m., the line being blocked ahead on account of difficulties with a snowed-up facing point lock at Gartshore. It was on a track circuit working a buzzer, and Signalman Smith declared it was impossible for him to have accepted the Dundee train, had Sneddon wrongly offered it. The possible mistaken lowering of the Castlecary signals for that train and their sudden replacement has been considered in connection with the case, but there is no evidence that such a thing occurred. It is also to be observed that Sneddon said he felt no need for a repeater on his down distant and never asked for it. He had always been able to work satisfactorily by refusing a



Plan showing debris around the locomotive of the Edinburgh-Glasgow express

train to Greenhill when the distant was obscured and Dullatur could not accept it. The Stationmaster, however, could not be certain the signalmen were working in accordance with rule in this matter, and thought he had never asked them about it.

During the few minutes before the Stationmaster and Fireman Fleming of the Dundee train came to the box, Sneddon tried to telephone to Control, but the circuit was occupied. He did not look out of the window but consulted the rule book; he did not recollect looking at the track indicator but had it shown "occupied" it would have attracted his attention. Driver Macaulay had sent Fleming to the box when he stopped—he unfortunately did not whistle—and the latter signed the register at 4.35 p.m. This entry was found tampered with, an unexplained and unsatisfactory feature of the case. Evidence is again conflicting, but Fleming declared that when he told Sneddon—who did not recognise him—who he was, the latter went to the telephone and told someone the Dundee train had stopped in the section and he corrected him, saying it was at the starting signal. Sneddon declared that Fleming said the train was *through* the starting signal, and asserted that he did not telephone. He did not look at the track indicator even then. Scott (the stationmaster) positively asserted there was no conversation between Fleming and Sneddon while he was in the box, which was only for a very brief period. He looked out of the window and saw the tail lamp of the standing train. He thought it was beyond the down starting signal. On entering section being received for the Edinburgh train they ran for detonators and went out, Sneddon with his red light. The latter first asserted to his own officers that he ran across the viaduct but later admitted he did not. The one detonator he was able to fix properly was between the down home and the west abutment, "30 to 50 yd." from the signal.

After the crash, Scott and Sneddon returned to the box. The former telephoned for assistance, and his services in organising relief work are highly spoken of. He went forward and then told Sneddon where the accident had happened; he himself had expected it to be further forward than it was; it was then he saw the track indicator showing "occupied." Sneddon suggested that the Dundee train must have moved back, and Scott supported this as he had previously thought that train to have been so much further forward. A similar impression seems to have been conveyed by Sneddon to Beattie (signalman at Greenhill Junction), while to Signalman G. McLeod, who relieved him at 8.0 p.m. (he stayed in the box, however, until 10.30 p.m.), he not only conveyed this idea but also that he had seen the track indicator at "occupied" *before* the accident.

Telegraph Lineman L. Robertson obtained a similar impression. He was responsible for maintaining the track circuit and said no question of its failure then arose. Another lineman thought similarly, on the strength of a conversation between Sneddon and another Signalman, N. Marr, but the latter gave contrary evidence. Nevertheless Sneddon said he did not know until 7.0 p.m. that the Dundee train was inside the starting signal, and denied having seen the track indicator at "occupied" before the crash. The integrity of the track circuit and/or its indicator was thus impugned by Sneddon's assertion that the "clear" indication was showing when the Edinburgh express was accepted at 4.32 p.m. He criticised Robertson's maintenance and said he falsely entered his (Sneddon's) name on the visiting sheet, and filled up the track circuit record card "sometimes six months at a time." He was "not going to be condemned on a track attended to in that way."

The matter was thoroughly investigated by Mr. W. A. Fraser, Engineer (Scotland), L.N.E.R.; Robertson's maintenance had been satisfactory, except for tidiness, since 1935. He would have to be dealt with concerning signing signalmen's names but he had certainly been at Castle Cary on the occasions for which he had signed Sneddon's name. From 1921 to date of accident three safety-side failures of this track circuit had been reported; one other—merely a slow return to the "clear" condition—occurred on April 17, 1937, but was not reported. Sneddon's reference to an unreported danger-side failure some 4½ years ago was vague

and there is considerable doubt about it. The indicator in question was thoroughly tested after the collision and no defect whatever found in it.

Chief Inspecting Officer's Conclusions

It is doubtful whether all the facts in detail will ever be fully established in this case. It is difficult to believe that a responsible signalman could do as Sneddon did and permit the Edinburgh express to approach when expecting the Dundee train to collide with the goods at Dullatur, still less plead justification because block regulations did not actually prohibit that. Doubt naturally arises as to the circumstances in which he had to stop the Dundee train. *Prima facie* there was also failure on the part of Drivers Macaulay and Anderson, and there were allegations regarding simultaneous failure of electrical and mechanical equipment, namely, a false "clear" track circuit and false "clear" distant signal. The case against the track circuit rests entirely on Sneddon's word. Scott supported Sneddon in this, but the impressions obtained by McLeod, Dickson, and Robertson, that Sneddon saw the indicator at "occupied" before he left the box with his lamp to stop the Edinburgh train, are probably correct. Sneddon's charge against Robertson regarding forging his signature will be dealt with, but the suggestion that Robertson was not attending to maintenance was unjustified. It is to be noted that Scott would not agree that he had actually seen the track indicator at "clear" before the accident. There seems little doubt that both Sneddon and Scott did hear what Fleming said, and difficult to believe they did not then look at the indicator. Nobody could—or would—explain why the time entered by Fleming in the train register was altered from 4.35 to 4.38 p.m. If Sneddon had intended to lay detonators he had all the time from 4.32 p.m. to do it in. Fleming criticised this failure and one doubts if Sneddon ever thought of the necessity for laying detonators. It seems that little reliance can be placed on Sneddon's or Scott's accounts; placing detonators may have been an afterthought instigated by Fleming's arrival and remarks, or observation of the indicator. It is difficult otherwise to account for their feeling that the Edinburgh train might also disobey signals. Sneddon could not explain his omission to look at the indicator when sending the emergency signal to Dullatur East, yet said he "very keenly" observed it when speaking to Beattie. His account is unconvincing, and little hesitation is felt in believing that no track or indicator failure occurred. Sneddon is 35, with 15 years service, 13 in his present capacity.

It seems surprising that such an experienced signalman as Beattie should have acquiesced in the acceptance of the Edinburgh train. Both Smith, at Dullatur East, and Sneddon strongly denied that the Dundee train had been accepted in error or signals wrongly lowered for it. Had Scott realised the position earlier Sneddon might have had time to rectify his mistake but blame is not attached to him for not doing so.

A false "clear" distant signal is a more likely occurrence than such a failure of the track circuit. Sneddon's view of the backlight must have been very problematical at 4.22 p.m., and it is unlikely that his word is to be trusted more in this respect than with regard to the indicator. Assuming he was able to see it the inaccuracy of the backlight blinder must be borne in mind. The integrity of the two drivers' evidence is of great importance. Their sincerity and confidence was impressive. Driver Macaulay estimated he saw the signal at 150 yd. and that it was "off" at 31 to 32 deg. (tested by model). Anderson said he saw it at 50 to 100 yd. and at 37 deg. from horizontal, but if the former was right the latter was wrong; the arm could not have increased its angle. Injured as Macaulay was, he went to the box after the collision and asked Sneddon if the down distant had a repeater. He was told not, and said the signal was clear—drooping, in other accounts of the talk—and Sneddon told him, losing his temper, not to "come that stuff." Sneddon indeed suggested that Macaulay had asked if there was a repeater so as to be able if possible to blame the signal and there is some reason in that. The word of the signalman is contradicted by two drivers;

the presumption in their favour is increased by doubt whether Sneddon could see the backlight at all, but the signal was undoubtedly "on" an hour later, as it had been at 3.35 p.m. If it was below horizontal for the two expresses vibration due to the heavier of them must have permitted it to return normal. There can be no definite conclusion about the position of the arm, but probabilities are against a danger-side failure.

There must be a suspicion that neither driver had sufficient time properly to view the signal; attention might have been relaxed at an unimportant station like Castlecary, but Anderson took correct action concerning an imperfectly displaced distant at Polmont on December 9, and was a careful driver. These two experienced drivers, separated by only 7 to 8 minutes, confirmed each other and so little reliance can be placed on Sneddon's and Scott's statements that it would be unfair to hold definitely that the signal was properly at "caution"; in absence of proof the drivers should have the benefit of the doubt.

It cannot be suggested they were not on the alert, and the question arises whether they were justified in maintaining speed in the conditions obtaining. Neither appears to have been complying with the spirit of Rule 127 regarding observance of signals in adverse weather, and it is difficult to relieve Anderson of incurring unnecessary risk in his approach to Castlecary; but he was aware of his location and was perhaps deceived by the better display of the electric signal lights at Greenhill junction. Had he been travelling at 40 to 50 m.p.h. instead of 70 the warnings he had might have prevented or greatly mitigated the collision.

Macaulay made a good stop and sent his fireman back promptly, although standing on a track circuit, but should have whistled and so cannot be relieved of some responsibility. This failure to whistle may have confirmed Sneddon in thinking the Dundee train had entered the section. The fairest conclusion is that Sneddon, perturbed that the train was not going to stop, misled himself into believing that the track indicator must have been at "clear." Later he was prepared to go any length in stressing the care with which he viewed it, to relieve himself of criticism. But he was gravely to blame for accepting the Edinburgh train without knowing the position of the Dundee train and while expecting an accident to it; and even had he known its position, he was to blame in accepting the following train when he had cause to suspect the reliability of the distant signal.

Remarks on Rolling Stock Construction

Telescoping is the principal risk in these cases, and a great deal of consideration has been given to it. The damage to the second and fifth vehicles of the Dundee train illustrates how in collision old-type coaches, generally speaking, afford less resistance in absorbing impact; but there are financial limits to obsolescence, and resistance to collision or derailment is not the primary consideration in designing passenger stock. Whatever material is used impact must be dissipated in some manner. Construction should be based on (a) prevention of one underframe overriding the other, and (b) if considerations permit, the strongest possible body to withstand the shearing forces of telescoping. Building heavy steel bodies and reinforced collision ends, stronger than the latest construction in this country, would be prohibitive; it is doubtful whether such unyielding carriages would have a materially greater casualty preventive effect, but they show to advantage if intermingled, as they should not be, with older and lighter stock. British practice now provides for shock being taken primarily by a massive steel underframe, with various anti-telescoping devices, carrying a wood, or wood and steel, structure.

The buckeye coupler and Pullman vestibule again proved their worth in this case. The retention of alignment of the Edinburgh express in rear of the third coach was remarkable. If the tender had been fitted with this coupler the extraordinary overriding of the first three coaches might have been prevented, but momentum would have been dissipated in greater damage to the Dundee train and it would not be safe to assume that 13 lives would have been saved in the other one. The screw coupling had no telescoping-

preventive effect, but, as an illustration of the danger of assumptions, a lady in this coach had merely a bruised eye and very slight shock.

A coach of the company's typical construction used in this train has about 66 per cent. steel and iron and 7 per cent. teak in it (by weight), accessories coming to 12 per cent. With other companies the steel rises to 88 per cent., so that not more than about seven tons of wood, in 32 tons, would be replaceable by steel. The Chief Mechanical Engineer is of opinion, after long experience, that for equal weight a body framing of steel is not likely to be so strong or so reliable in maintenance as a massive teak structure. Such rapid progress is, however, being made in high-tensile steel alloys and welding that the time should not be far distant when the factors of insufficiency of strength and unreasonably increased weight, cost and maintenance, will no longer render impracticable the more general use of lightweight all-metal construction.

Such construction would not, however, have withstood the terrific shock of this collision any better than the latest coaches concerned; the crumpling of the underframes was significant. The severity of an accident might be increased if the blowpipe had to be used to liberate passengers. The policy of adhering to articulation, buckeye couplers, and Pullman vestibules has outstanding merits; there is no justification for pressing the companies unduly to accelerate departure from their general practice, which is gradually attaining the ideal of uniform strength throughout the train. The policy of all companies in primarily directing resources to prevention of accidents is unhesitatingly supported.

Importance of Marshalling

It seems likely that five passengers were killed in the Edinburgh train because the leading brake compartment was not next to the engine. The present instruction in the area says: "All passenger trains should, when practicable, have a brake compartment next to the engine." This is regarded as an obligation only when no inconvenience or delay results, but one of the vehicles concerned will now normally always be in rear of the brake van in this train, and the second also, only required between Edinburgh and Glasgow, unless traffic conditions are exceptional. The companies generally should give further consideration to this matter, and influence the traffic staff to marshal additional vehicles within the brake van rather than let inconvenience interfere.

Signalman Sneddon's suggestion that the block regulations should be made to cover specifically the circumstances of this case appears unnecessary; it is better to leave the matter to initiative and commonsense. Driver Macaulay should have whistled when he stopped and the inclusion of a specific reminder affecting Rule 55 (detention of trains on running lines), as on the G.W.R. and S.R., should be considered.

Rule 81 (*h*), regarding warning drivers of distant signal failures, practically unchanged since an amendment in 1930, clearly assumes a signalman to be aware when his signals are defective; repeaters are thus necessary. In the absence of one, the words "the temporary absence of such a signal" may not be sufficiently explicit to cover what they were stated to do, that is the inability to see a signal. This apparently was the reason for the now-cancelled N.B.R. instruction already quoted, which Sneddon said he still followed. Any doubt should be removed in future by suitable definition, to ensure traffic being brought under the rule when a non-repeated signal cannot be seen.

The Distant Signal

This accident illustrates the importance of the distant signal; for many years signalmen have been assisted by repeaters, but their indications may be ignored or overlooked; interlinking between distant signal and block instrument ensures a train not approaching unwarned unless the signal is working properly, and providing the signalman correctly adjusts the wire. Repeater are installed at 81 per cent., and proving at 31 per cent., of the distant signals on the main Edinburgh—Glasgow line. The early completion of such work is strongly recommended on all main high-speed lines. The view of the distant and interval to the home

signal should be adequate for all classes of traffic and speeds on the line.

It is possible that the distant signal was at caution when both expresses approached; in that case A.T.C. could have prevented the accident. The term covers a wide field and a Departmental Committee reported on it in 1922 and 1930. On main lines, where speeds are high, the control appliance should act before the stop signal is reached, and train-stops as used by the L.P.T.B., the simplest form of these devices, are not suitable. Warning control does not compel an irrevocable stop but warns the driver of a stop signal ahead, usually with a combined brake application which the driver can cancel; in its simplest form this device may be a location control acting at all times.

A.T.C. for Main Lines

The G.W.R. has its intermittent contact apparatus in use over 2,850 track miles, with 2,110 distant signal locations and 3,250 locomotives. The L.M.S.R. has inductive apparatus of similar scope and function on the Southend line; a report thereon is awaited. Cab signal equipment, without control of train speed or brake, is another arrangement; when continuous in action, it is possible only with continuous track circuiting, and the 1930 report said that, while providing the most complete direct protection against accident, the heavy expenditure involved would not be justified "having regard to the high degree of security now maintained on British railways." Various systems of cab signal and A.T.C. are in use in the United States, France, Switzerland, and Germany; the advantages of control systems are therefore generally recognised, but after such an accident as Castle Cary it is important neither to exaggerate the extent to which casualty would have been prevented nor ignore other means to increased safety.

Since the 1930 report progress has been made in lighting and providing colour-light equipment; a colour-light signal might have prevented this accident and such distant signals are being introduced. The advantage of "indirect" safeguards is that they are effective for every movement and more can be done for a given expenditure towards improving safety conditions and easing the task of the careful driver. It is possibly better to improve signal display, location, &c., before adding control devices, but the only positive safeguard against certain classes of accident is some form of A.T.C. Cost of complete apparatus would not be justified but warning control goes some way to meet requirements. There are difficulties in combining such two-aspect control with multiple-aspect signalling, and when the latter is being extended on heavily trafficked medium-speed suburban and urban lines, it should take preference. The majority of heavy main-line mileage will remain for many years signalled under the two-aspect system, on which control of ultra high-speed services is being imposed.

A compromise would be to omit control for the present under multiple-aspect signalling and apply it to the two-aspect. It might logically be restricted to certain routes and certain trains under high-speed operation, track apparatus being located at suitably varying distance in rear of distant signals. Investigations over some years show that warning control would have proved beneficial in a good proportion of accidents, while the number of potential collisions should not be overlooked. The problem of the L.N.E.R., on whose lines various devices have been tried in the past, appears to be similar to that of the L.M.S.R. in the main; preference should be given to perfecting the existing signalling and its safeguards, enabling drivers to observe and obey signals while maintaining schedule, and to the application of warning control, now widely accomplished on the G.W.R. with satisfaction and benefit. The company should take early steps to reach decisions in the matter and is understood to be in active collaboration with the L.M.S.R.

No suggestion received from the public over this accident seemed of sufficient importance to warrant reference. The help given by the company's officers and the unions' representatives is acknowledged.

[The full report of this accident comprises 63 pages and four sheets of diagrams, and is published by His Majesty's Stationery Office, price 4s. net.—Ed. R.G.]

Institution of Railway Signal Engineers

Summer meeting at Bristol

(See illustration on page 1206)

The annual summer meeting of the Institution of Railway Signal Engineers was held at Bristol from June 16 to 18. About 100 members and ladies were present, under the leadership of the President, Mr. G. H. Crook, Chief Assistant to the Signal Engineer, G.W.R. Mr. Crook was supported by:—

Mr. James Boot (Vice-President), Signal Engineer, General Railway Signal Co. Ltd.; Messrs. F. Downes, J. W. Punter, R. S. Griffiths and H. M. Proud (Past Presidents); Messrs. F. L. Castle, H. H. Dyer, C. H. Hills, F. Horler, L. J. M. Knotts and F. H. D. Page (Members of Council); and Mr. M. G. Tweedie (Honorary Secretary).

On June 16 a visit was paid to the extensive works of the Westinghouse Brake & Signal Co. Ltd. at Chippenham; members who travelled from London were entertained to lunch on the train by that company and were joined at the works by others. Here the party was received by its officers and engineers and conducted by guides on a two-hour tour of the establishment, where a great variety of most interesting equipment was seen under construction. Ladies were able to see the works or make a coach tour in the surrounding district. Tea was served in restaurant cars, which had been moved into a siding, and the party proceeded to the company's fine sports ground on the outskirts of the town, where all kinds of games were enjoyed and supper provided.

Mr. W. H. Powell, Director and General Manager, expressed the pleasure of the Westinghouse Company at receiving the party, to which Mr. G. H. Crook replied.

Proceeding to Bristol the members spent the morning of June 17 in an inspection of the large all-electric power signalling installation at Temple Meads station, supplied by the General Railway Signal Co. Ltd., comprising a total of 590 electric slide levers, making over 24,500 lever movements every 24 hr., controlling 219 point machines and 357 signal units. The automatic and manual telephone exchanges were inspected, also the three-channel carrier telephone equipment working to London and Cardiff, and the Creed teleprinter apparatus working to London, Bristol and Exeter. The novel pneumatic tube system installed by Siemens-Schuckert was also inspected; this links the various groups of G.W.R. offices in Bristol on the ring principle, over 600 carriers being sent by it daily. The method of effecting the block working principle in the tubes is of much interest. In the G.W.R. locomotive depot that company's A.T.C. apparatus was demonstrated by a locomotive, on which the visitors could ride, arranged to travel to and fro over a ramp, a distant signal being in operation. During this visit ladies made a motorcoach tour of the city, arranged by the Bristol Development Board.

Lunch was provided by the Great

Western Railway at the Grand Spa Hotel, Clifton, where the chair was taken by the Signal Engineer, Mr. F. H. D. Page, supported by Mr. R. G. Pole, Divisional Superintendent; Mr. W. N. Pellow, Divisional Locomotive Superintendent; Mr. C. A. Neale, Assistant Divisional Engineer; Mr. R. J. G. Barefoot, Divisional Goods Manager; and members of the Signal Engineer's staff. Mr. Page welcomed those present to Bristol on behalf of the railway company, and Mr. G. H. Crook responded, thanking the company through Mr. Page for the hospitality the members had received and the facilities granted them for seeing technical equipment.

A coach visit was made to Bath in the afternoon and a dinner held in the evening with Mr. Crook in the chair, the guests being the Divisional Officers of the G.W.R. with their ladies. After the loyal toast Mr. Crook submitted that of their hosts, and referred to the kindness of the Westinghouse Company, the railway company, and the General Railway Signal Co. Ltd., by

whom they were to be entertained on the following day.

Mr. H. M. Proud responded on behalf of the first named, Mr. F. H. D. Page for the G.W.R., and Mr. James Boot for the G.R.S. Company. Mr. F. Downes proposed the guests, and Mr. R. G. Pole, Divisional General Manager, Bristol, G.W.R., replied. A dance followed, with Mr. C. H. Hills, Member of Council, as M.C.

On June 18 a coach trip was made to Cheddar Gorge and Wells; lunch was provided by the General Railway Signal Co. Ltd. Mr. G. H. Crook presided and expressed the thanks of those attending the meeting to his colleagues on the General Purposes Committee who had made the arrangements, namely Messrs. R. S. Griffiths, J. Boot, F. L. Castle, C. H. Hills, R. F. Morkill, and their energetic Hon. Secretary, Mr. M. G. Tweedie. Mr. Tweedie replied for the committee.

Mr. F. L. Castle expressed the pleasure felt at having overseas members present, and Mr. H. L. Carter, District Signal Engineer, East Indian Railway responded. A visit was made to Wells cathedral, and the meeting terminated again at Bristol, having been held under excellent weather conditions and enjoyed thoroughly by all.

STAFF AND LABOUR MATTERS

Decision of Chairman of the Railway Staff National Tribunal

Decision No. 2 of the Chairman of the Railway Staff National Tribunal, dated June 16, 1938, deals with a claim "that a steam hopper dredger which takes its own spoil to sea is a sea-going hopper dredger within the meaning of the Agreement of December 1, 1920." The claim required decision on the basis of an agreed statement, signed on behalf of the National Union of Railwaymen and of the railway companies, and was one regarding interpretation of the agreement which prescribes certain special rates of pay for "sea-going hopper dredgers"; the Chairman therefore had no power to vary the agreement but only to interpret it. The question is whether a dredger which is not a "ladder bucket dredger" is included within the category of "sea-going hopper dredgers."

The decision states that on March 17, 1921, a committee representing the union and the companies authorised the Chairman to issue an explanatory slip amplifying the decisions of the main agreement. The Chairman accordingly issued a slip in which he stated that "sea-going hopper dredgers are intended to refer to ladder bucket dredgers." If this slip is regarded as either a valid amplification of the original agreement or as a correct interpretation of it, it is clear (and indeed does not appear to be disputed) that the present claim of the union must fail.

The National Union of Railwaymen submitted reasons for holding that,

owing to defects in the procedure, the slip should not be regarded as valid, that is as a substantial part of the agreement now to be interpreted. The companies submitted reasons for taking a contrary view. The union's claim on this point is weakened by the fact that the "slip" appears to have been unchallenged for over fifteen years, and indeed upon occasion to have been implicitly accepted and used in connection with certain claims.

The Chairman of the Railway Staff National Tribunal states that even if the union's contention on this point were accepted, it would not be equivalent to the rejection of the Chairman's interpretation as a correct interpretation, and the Chairman of that time was obviously in a better position to know the minds of the parties at the time at which the original agreement was made. In other words, in order to decide in favour of the union's present claim, he would have to decide both that the Chairman's slip is invalid as an integral part of the agreements now in force, and also that his opinion was incorrect as an interpretation of the original agreement. He cannot do this on the evidence submitted to him, and he therefore finds against the claim.

[The first decision given by the independent Chairman of the Railway Staff National Tribunal upon a claim referred to him, personally, for determination was mentioned in an editorial note last week.—ED. R.G.]

Great Western Railway Summer Services

In the summer timetables of the G.W.R. the most important change is that the through connection to the direct steamer services from Fishguard to Waterford and Cork is transferred from the 5.55 p.m. train from Paddington to the considerably faster 6.55 p.m. express, which was brought into operation last year, and as Waterford and Cork are reached at the same times as previously, an acceleration of an hour is effected, half of it on the run from Paddington to Fishguard. Swansea also gets a fast evening service from London in 3½ hr., faster by 12 min. than any previously operative. Elsewhere there are several useful accelerations. The 7.5 a.m. from Plymouth to Paddington leaves at 7.20 a.m., with a correspondingly later departure from Torquay, and despite additional stops at Teignmouth and Dawlish, reaches Paddington at 11.50

a.m., 5 min. later than now, for the first time introducing a 3 hr. booking from Exeter to London with two intermediate stops; the 47.1 miles from Taunton to Westbury are booked in 48 min., and the 95.6 miles thence to Paddington in 92 min. start to stop—the fastest Westbury—Paddington booking on record. The 1.30 p.m. from Paddington starts at 1.40 p.m., but picks up its previous times from Exeter onwards. The 7.30 a.m. express from Birmingham to Paddington leaves at 7.45 a.m., and making five intermediate stops (only the previous Warwick stop is omitted) reaches Paddington at 10 a.m. as now; the 3.55 p.m. from Birmingham to London calls at Banbury as well as Leamington but still arrives at 6 p.m. The previous 7.30 a.m. from Birmingham (6.55 from Wolverhampton) runs independently to Banbury, takes up from

there the working of the previous 8.40 a.m. (now 8.30) to Oxford, and forms from Oxford a new 72-min. service at 9.5 a.m. to Paddington, calling only at Didcot and running the 53.1 miles from Didcot to London in 53 min. The 8.35 a.m. from Oxford to Paddington starts at 8.40 a.m., and is accelerated 5 min., running the 58.3 miles from Radley in 61 min. A new train at 3.30 p.m. from Swansea to Cardiff, calling at principal intermediate stations, will connect with the 4.50 p.m. express railcar from there, and give a service from Swansea to Birmingham in 3¼ hr. Minor accelerations, in some cases of a single minute, introduce further mile-a-minute runs, principally the 3.17 p.m. from Oxford to Paddington (63.5 miles in 63 min.), the 5.9 p.m. from Westbury to Taunton (47.1 miles in 47 min.), the 4.18 p.m. from Swindon to Paddington (77.3 miles in 77 min.), and the 5.40 p.m. from Swindon to Reading (41.3 miles in 40 min.).

Another L.M.S.R. Engine named after County Regiment

Naming ceremony of engine No. 6131 "Royal Warwickshire Regiment" at New Street station, Birmingham

On Monday afternoon last at New Street station, Birmingham, Brigadier C. T. Tones, D.S.O., M.C., Colonel of the Royal Warwickshire Regiment, performed the ceremony of naming the L.M.S.R. engine No. 6131, *Royal Warwickshire Regiment*, the crest for which had been presented by Lt.-Colonel P. M. Brooke-Hitching.

Those present at this ceremony included the Lord Mayor of Birmingham (Councillor E. R. Canning, J.P.), Brigadier C. T. Tones, D.S.O., M.C., Brig.-General Sir W. Ludlow, C.B., V.D., T.D., Major H. B. Bird, O.C. Depot, Colonel F. S. Hanson, D.S.O., M.C., Lt.-Col. R. H. Baker, Lt.-Col. Hon. C. D. Siddeley, Brigadier O. D. Smallwood, C.B.E., Lt.-Col. P. M. Brooke-Hitching, Colonel Sir Bertram Ford, Managing Director, *Birmingham Mail and Post*, Mr. E. W. Record, Editor, *Birmingham Post*, Mr. J. A. Kay, Editor, *THE RAILWAY GAZETTE*, Mr. W. E. Hart, Divisional Superintendent, Birmingham, G.W.R.

The London Midland & Scottish Railway Company was represented by Mr. W. A. Stanier, Chief Mechanical Engineer, Mr. G. H. Loftus Allen, Advertising and Publicity Officer, Mr. G. R. Bradbury, District Passenger Manager, Birmingham, Mr. J. B. Scattergood, District Goods Manager, Birmingham, and Messrs. W. Sinclair, G. A. Grimoldby and W. C. Brudenell.

Mr. W. A. Stanier, in a brief speech welcoming the guests, stated it had been intended that Mr. S. R. Beale, a Director of the company, would have been present at the ceremony, and he apologised for his absence. Continuing, he referred to the generosity of Lt.-Colonel Brooke-Hitching, who had presented the crest for the engine, and welcomed the presence of the Lord Mayor and so many past and present officers and men of the Royal Warwickshire Regiment.

Brigadier C. T. Tones, in replying, after paying a tribute to the Lord Mayor for the interest he had shown in the county regiment, said they were also

indebted to Mr. Stanier and Mr. G. R. Bradbury, who had done so much towards making the ceremony possible. It was appropriate that an engine should bear the name of the Royal Warwickshire Regiment because 80 per cent. of the strength of the regiment was made up of men from the neighbourhoods of Birmingham and Coventry. Many of the discharged soldiers had found employment with the L.M.S.R.,

and many other discharged men lived in the Birmingham district. On behalf of the regiment he wished the engine the best of luck wherever it went, freedom from mishaps and long service.

The Lord Mayor referred to the great work of the railways during the period of the great war, and said that if another such emergency arose they would need the services of the railways.

The driver of the engine (A. Paddock) and the fireman (P. Munn), both ex-Royal Warwickshire Regiment men, were each presented with a silver tankard from Colonel Brooke-Hitching as a souvenir of the occasion. Brigadier Tones made the presentation.

Parliamentary Notes

L.N.E.R. Bill

The Unopposed Committee of the House of Lords on June 20 reported this Bill for third reading.

Southern Railway Bill

This Bill was on June 20 reported for third reading by the Unopposed Committee of the House of Lords.

Questions in Parliament

Cheap Railway Tickets

Mr. E. H. Keeling (Middlesex, Twickenham—C.) on June 16 asked the Minister of Transport if the London Passenger Transport Board exempted itself from liability at common law in respect of accidents to persons travelling with cheap tickets.

Dr. Leslie Burgin (Minister of Transport): The London Passenger Transport Board has informed me that it will not in future, in respect of any of its services, seek to exempt itself by special contract from its liability at common law in respect of injury—fatal or otherwise—to passengers (other than those holding privilege tickets or

free passes) when travelling in the board's vehicles or whilst in the act of entering or alighting from such vehicles. Where in the case of passengers holding workmen's tickets who may be injured in such circumstances the board's liability at common law is limited by special Act, the board will not plead such limitation. I am glad to say that the board has decided to apply this concession to accidents which occurred on or after May 1, 1938.

A Tottenham Level Crossing

Mr. Robert Morrison (Tottenham N.—Lab.) on June 20 asked the Minister of Transport if he would ascertain when the L.N.E.R. proposed to abolish the dangerous level crossing at Park Lane, Tottenham.

Dr. Leslie Burgin: I presume the hon. member refers to the level crossing at the country end of Northumberland Park station. I am informed by the L.N.E.R. that no serious accident has taken place at this crossing and that there appears to be no reason why it should be described as dangerous. I am, of course, prepared to consider an application for the responsible highway authority for a grant from the Road Fund towards the cost of its abolition.

RAILWAY AND OTHER MEETINGS

British Electric Traction Co. Ltd.

The annual general meeting of the British Electric Traction Co. Ltd. was held at Winchester House, Old Broad Street, London, E.C.2, on June 17, Mr. J. S. Austen, Chairman of the company, presiding.

The Secretary (Mr. Thomas Bower) read the notice convening the meeting and the auditors' report.

The Chairman, in moving the adoption of the report and accounts, said that they had had a very good year, and their profits had increased by £55,000 over last year, which itself showed an increase of £59,000 over the previous year. It was quite fair to say that their company was worth, treated as a going concern, a million more than it was last year. They had added the large sum of £185,000 to their undivided profits account, and in that connection he must say that every year he received one and sometimes two letters from shareholders asking the company to ladle out something from that fund; but as they had over 3,500 holders of their deferred stock a letter or two did not worry him. With that stock they must not look for income, but for increase of capital value. It was, in fact, a sort of automatic savings bank, and when he said that an original owner of £100 of that stock who had kept all the bonuses was now worth some £4,500 even at the depreciated price of the stock, he did not think it could fairly be said the company had failed.

With regard to the Budget and the petrol tax, the Chairman said their company was probably one of the largest buyers of petrol in the country, and 1d. a gallon spread over a year meant a very large sum indeed on the amount which they purchased. They looked upon petrol as a raw material, the price of which was liable to go up and down; but petrol was subject to a tax, and that tax was liable to go up but they had never had any experience of it going down. Every tax was a necessary evil, but it seemed to him that this tax was rather more evil and rather less necessary than usual, because he regarded it as a tax on industry.

The petrol tax also influenced them in another direction. They were taking a small interest in an aviation company which was trying to make a profit from running air services without a Government subsidy, and that was a thing that had never yet been done. He had nothing good to say about subsidies, but of course in the present case they could do with one. In the business of a subsidy, it was at least surprising that the Government should go and put a tax on them, as they had done by means of the tax on petrol, and it was especially annoying when one remembered that a large proportion of that tax did not go to the Government at all but to road maintenance and improvement.

It was very difficult to say anything in general terms about the bus business. Expenses had gone up owing mainly to increases of wages, but on the average it had come out fairly square. Of course they must not expect the phenomenal increases which

they had had during the past two years, but at the moment he did not know that there was, outside the general situation, any reason why they should not show at least a moderate increase in the current year.

The report and accounts were unanimously adopted. A further resolution for the capitalisation of £65,352 out of the profits for the year, to enable a dividend of 10 per cent. on the deferred ordinary shares to be declared, was also adopted unanimously.

Great Western of Brazil Railway Co. Ltd.

The annual general meeting of the Great Western of Brazil Railway Co. Ltd. was held at River Plate House, Finsbury Circus, London, E.C.2, on June 21, Mr. G. H. Harrison, C.M.G., M.Inst.C.E., Chairman of the company, presiding.

The Secretary (Mr. F. O. Ellis) read the notice convening the meeting and the auditors' report.

The Chairman, in moving the adoption of the report and accounts, referred to the loss sustained by the company in the recent death of Colonel Woodbine Parish, who had been a member of the board longer than any of the present directors. He also mentioned the appointment of Mr. F. O. Ellis as Secretary of the company in succession to Mr. Medlycott, who had gone to fill that post with the Central Uruguay Railway Company.

He regretted to say that the results for the year under review were even more disappointing than those for the previous one, which was mainly due to overtaking arrears of maintenance, the low rate of exchange, the poor sugar crop of 1936/7, and increased expenditure resulting from certain social laws. A petition to the Brazilian Government to compensate the company for short earnings had been made four years ago, but final approval to the terms proposed had yet to be obtained.

When, towards the end of last year, the company had found itself unable to meet the 4 per cent. debenture interest,

the question of priority of claim of the permanent 6 per cent. debenture holders had arisen. An application to the High Court had not finally settled the question of priority, so the company had at another meeting that day submitted proposals regarding the standing of the 6 per cent. stock to both classes of debenture holders for their approval. The directors had unfortunately no alternative to asking holders of the debenture and the debenture stock for a moratorium of interest for the present year, and, if unavoidable, for a further two years. The debit balance on net revenue account in the year under review had reached £350,000, and the lower rate of exchange, coupled with higher working costs, precluded any large improvement in the results for 1938. A new burden on the company was the increase of 10 per cent. in the quota of Brazilian coal which the company was obliged to purchase for every ton imported. This was a low grade fuel suitable only for stationary boilers and shunting engines.

Concluding, the Chairman referred to the greater cordiality in the relations between the public and the railway, a result which was largely due to the personality of their General Manager, who was held in the highest esteem both by the general public in Brazil and the staff of the railway.

The report and accounts were unanimously adopted.

Exports of Railway Material from the United Kingdom in May

	May, 1938	May, 1937	Five Months May, 1938	Ending May, 1937
Locomotives, rail	160,920	28,480	611,940	466,976
Carriages and wagons	361,576	283,278	1,475,076	1,184,219
Rails, steel	121,994	120,649	628,669	434,230
Wheels, sleepers, fishplates and miscellaneous materials	190,632	120,640	883,981	538,099
Locomotive and rail exports included the following :—				
	Locomotives		Rails	
	May, 1938	May, 1937	May, 1938	May, 1937
Argentina	9,728	20,155	4,628	1,811
Union of South Africa	—	—	43,016	17,062
British India	8,457	14,270	16,613	12,877

* Figures not available

NOTES AND NEWS

Train Wrecking on the East Indian Railway.—On June 7 the East Indian Railway Calcutta-Punjab mail train was derailed, and two persons were killed and 34 injured. As evidence points to deliberate train-wrecking, the railway administration is now offering a reward of Rs. 5,000 (£375) to anyone giving evidence leading to the detection of those responsible for this sabotage.

American I.C.C. to Reconsider Eastern Railways' Request for Higher Passenger Fares.—According to a Reuters message from New York, the Interstate Commerce Commission has agreed to reconsider its recent decision refusing to sanction the Eastern railway companies' demand for an increase in passenger fares from 2 cents to 2½ cents a mile.

Royal Visit to Paris.—The Royal train by which King George VI will travel to Paris for his forthcoming visit to the French capital, will be made up of a saloon car, two Pullman cars, a restaurant car, an ordinary first class passenger coach, and a baggage car. It will be hauled by one of the latest streamline super-Pacific engines of the French National Railways.

Buenos Ayres & Pacific and Argentine Great Western.—Separate meetings have been called for June 29 of holders of the 4½ per cent. consolidated debenture stock and of the 5 per cent. (1912) debenture stock of the Buenos Ayres & Pacific Railway Company, and of holders of the 5 per cent. debenture stock and of the 6 per cent. guaranteed preference stock of the Argentine Great Western Railway Company to consider a scheme of arrangement proposed to be made between the two companies and their respective stockholders.

Southern Railway Awards for Staff Suggestions.—Awards to the staff, made under the Suggestion Scheme inaugurated by the company some time ago, were made by the General Manager, Mr. Gilbert Szlumper, at Waterloo, on June 16. These suggestions cover all sides of railway activities, both in reducing expenditure and in increasing revenue. The principal award of £25 was made to Mr. C. Andrews, Ticket Collector, Eastbourne, from whom 15 useful suggestions have been adopted during the last two years. Awards for other suggestions were made to 16 other members of the staff.

G.W.R. Engines Named After Brunel and Gooch.—The memory of two men famous in railway history—Isambard Kingdom Brunel and Sir Daniel Gooch—is to be perpetuated by the Great Western Railway by the naming of engines of the "Castle" class after them. I. K. Brunel was the company's first Engineer, who planned and built the line from Paddington to Bristol. Sir Daniel Gooch was the company's first Locomotive Superintendent, founder of Swindon works,

and later Chairman of the company. Both locomotives are going into service immediately, and will be stationed at Old Oak Common, London.

Address Change.—Murex Welding Processes Limited has removed to new offices and works at Hertford Road, Waltham Cross, Herts. The new telephone number is Waltham Cross 1050.

Acetylene Plant for Railway Works.—A central acetylene generating plant, with a pipeline system having hydraulic safety and isolating valves, will very shortly be installed at Gorton works, Manchester, L.N.E.R., where 158,000 cu. ft. of gas are used every year for welding and cutting. Gorton was the principal works of the former Great Central Railway, and is still an important locomotive works of the L.N.E.R.

West Sussex Railway.—The *London Gazette* for June 21 records that the Hundred of Manhood & Selsey Tramways Co. Ltd. will be struck off the register of joint stock companies at the expiration of three months from June 21, unless cause is shown to the contrary. This company was the owner of the West Sussex Railway, running between Chichester and Selsey, which was opened on December 1, 1897, and closed on January 19, 1935. The line has since been dismantled.

The Charing Cross, District Line, Collision.—Two employees of the London Passenger Transport Board, Arthur George Beer, Chief Lineman, and Arthur Walter Foskew, Station Foreman of Temple station, were dismissed as a result of the Charing Cross collision of May 17. At the inquest the jury found that the accident was caused by the serious negligence of Beer and the contributory negligence of Foskew, but that in neither case did it amount to criminal negligence. The National Union of Railwaymen is seeking to secure the reinstatement of the two dismissed men, but it is understood that the L.P.T.B. has stated that, so far as it is concerned, the matter is closed.

Northern Ireland Traffics.—Passengers carried on railways wholly in Northern Ireland (excluding season-ticket holders) in the first three months of 1938, numbered 791,567, compared with 794,697 in the first three months of 1937, and ordinary passenger receipts fell from £46,619 to £43,971. Merchandise and minerals conveyed in the first three months of 1938 amounted to 136,014 tons, a decrease of 7,500 tons in comparison with the first three months of 1937; the number of livestock fell from 51,654 to 50,172, and the total goods traffic receipts from £53,436 to £50,576. On railways partly in Northern Ireland, the ordinary passengers in the first three months of 1938 were 931,495, against 964,249 in the first three months of 1937, and they brought in receipts of £81,841, which were £2,627 lower. Merchandise and mineral tons dropped

from 230,366 to 216,191, but the number of livestock rose from 159,738 to 161,228, and the total receipts from goods traffic were £148,463, against £151,399 for the first three months of 1937.

Leeds Corporation Light Railways.—The Leeds Corporation is applying to the Minister of Transport for an Order prolonging until July 15, 1940, the period limited for the completion of the light railways authorised by the Leeds Corporation Light Railways (Extension) Order, 1935.

United Railways of the Havana.—Mr. Justice Simonds sanctioned on June 20 a scheme of arrangement petitioned for by the United Railways of the Havana and Regla Warehouses Limited. The operation of the original scheme of June 27, 1930, for a moratorium in respect of interest payments, was, by further schemes sanctioned in 1932 and 1935, extended for further periods expiring on dates varying from July 1 to October 1, 1937, with power to the stockholders' committee to extend it for a further period of one year. In June, 1937, the committee approved such extension and the scheme was therefore due to expire during the latter part of the present year. The extension which the Court has now sanctioned is for a further period of at least two years.

Steel Cartel Conference.—A conference of the International Steel Cartel was held in Rome last month. Four meetings were held, among which one, presided over by Dr. William Firth (Great Britain), dealt with tinplate and reached an agreement in principle for the renewal of the cartel until June 30, 1941. At another meeting the undertakings of the Railmakers' Association, already in force, were confirmed after an examination of the international market. Other questions discussed were the development of agreements between the various cartels with respect to the U.S.A. steel industry, and methods of acquisition of scrap by European consumers in the world market; the existing agreements in both matters were confirmed.

Express Plunges Through Washed Out Bridge in U.S.A.—On June 19 the Olympian, the well-known express of the Chicago, Milwaukee, St. Paul & Pacific Railroad, was wrecked about 25 miles east of Miles City, Montana, owing to two 50-ft. spans of a bridge having been washed away in a cloudburst. Some 123 passengers were travelling by this train, which consisted of 12 cars, and only 30 escaped unhurt, 65 being injured and 28 losing their lives, mainly, it seems, by drowning. The bridge is on a curve, and the driver had no warning of the washout until too late. The engine, baggage van, mail van, two coaches, and two tourist sleeping cars fell into the flooded Custer Creek, a tributary of the Yellowstone River. Patrolmen noticed nothing wrong with the bridge when they inspected it during the night. In 1901

also a serious accident occurred on the Great Northern system near Montana, when the brakes leaked off an east-bound freight train, from which the engines had been detached, and 28 freight cars ran down the steeply graded line for 17 miles and then crashed into a passenger train, also east-bound; 41 lives were then lost.

The Engineers' Guild.—As recorded in THE RAILWAY GAZETTE of May 20, the Engineers' Guild was inaugurated at a meeting of engineers in Caxton Hall, Westminster, on May 16. The objects of the guild as stated in the temporary constitution then adopted are:—

To promote the social and economic welfare of the engineer, to stimulate public service in the profession, to encourage and develop the efficiency of the engineer, and to promote unity in the profession.

The council of the guild consists of 15 members elected at the inaugural meeting with power to co-opt not more than eight additional members. It is provided that the council must submit to a general meeting of the guild, to be held not later than May 31, 1939,

proposals for a revised constitution and by-laws. For the duration of the present temporary constitution, the only persons eligible for membership of the guild are members and associate members of the Institutions of Civil, Mechanical, and Electrical Engineers, and Naval Architects. The subscription for membership of the guild for the period ending May 31, 1939, is £1 1s. 0d. Applications for membership and other communications should meantime be addressed to Mr. T. W. Andrews, A.M.I.Mech.E., Acting Joint Secretary, 68, Brooklands Park, London, S.E.3.

Forthcoming Events

June 25-30.—Permanent Way Institution, at Cologne. Summer Convention.
June 30 (Thurs.).—Institution of Electrical Engineers (London), at Natural History Museum, S.W.7. Annual Conversation.
July 2-3.—Stephenson Locomotive Society. Tour of L.N.E.R. Sheds (N.E. Area.)
July 4-8.—Institution of Electrical Engineers at Grand Hotel, Birmingham. Summer Meeting.
Sept. 19-23.—International Management Congress, at Washington, U.S.A.
International Rail Assembly, at Düsseldorf.

British and Irish Traffic Returns

GREAT BRITAIN	Totals for 24th Week			Totals to Date		
	1938	1937	Inc. or Dec.	1938	1937	Inc. or Dec.
L.M.S.R. (6,852½ mls.)	£	£	£	£	£	£
Passenger-train traffic...	574,000	546,000	+ 28,000	10,878,000	10,874,000	+ 4,000
Merchandise, &c. ...	445,000	512,000	- 67,000	11,285,000	11,765,000	- 480,000
Coal and coke ...	229,000	225,000	+ 4,000	6,323,000	6,464,000	- 141,000
Goods-train traffic ...	674,000	737,000	- 63,000	17,608,000	18,229,000	- 621,000
Total receipts ...	1,248,000	1,283,000	- 35,000	28,486,000	29,103,000	- 617,000
L.N.E.R. (6,315 mls.)						
Passenger-train traffic...	372,000	371,000	+ 1,000	7,061,000	7,149,000	- 88,000
Merchandise, &c. ...	307,000	360,000	- 53,000	7,868,000	8,136,000	- 268,000
Coal and coke ...	214,000	233,000	- 19,000	5,980,000	6,097,000	- 117,000
Goods-train traffic ...	521,000	593,000	- 72,000	13,848,000	14,233,000	- 385,000
Total receipts ...	893,000	964,000	- 71,000	20,909,000	21,382,000	- 473,000
G.W.R. (3,737 mls.)						
Passenger-train traffic...	230,000	235,000	- 5,000	4,525,000	4,568,000	- 43,000
Merchandise, &c. ...	182,000	210,000	- 28,000	4,575,000	4,724,000	- 149,000
Coal and coke ...	102,000	109,000	- 7,000	2,695,000	2,733,000	- 38,000
Goods-train traffic ...	284,000	319,000	- 35,000	7,270,000	7,457,000	- 187,000
Total receipts ...	514,000	554,000	- 40,000	11,795,000	12,025,000	- 230,000
S.R. (2,148 mls.)						
Passenger-train traffic...	371,000	373,000	- 2,000	7,029,000	7,056,000	- 27,000
Merchandise, &c. ...	63,000	68,000	- 5,000	1,440,000	1,463,500	- 29,500
Coal and coke ...	24,000	27,000	- 3,000	749,000	775,500	- 26,500
Goods-train traffic ...	87,000	95,000	- 8,000	2,189,000	2,245,000	- 56,000
Total receipts ...	458,000	468,000	- 10,000	9,218,000	9,301,000	- 83,000
Liverpool Overhead ...	1,456	1,341	+ 115	32,319	29,256	+ 3,063
(6½ mls.)						
Mersey (4½ mls.) ...	4,077	3,952	+ 125	104,446	100,523	+ 3,923
*London Passenger Transport Board ...	575,300	557,100	+ 18,200	28,803,000	28,157,900	+ 645,100
IRELAND						
Belfast & C.D. pass. ...	2,768	2,919	- 151	46,348	48,679	- 2,331
(80 mls.)						
" " goods ...	387	501	- 114	10,332	11,879	- 1,547
" " total ...	3,155	3,420	- 265	56,680	60,558	- 3,878
Great Northern, pass. ...	10,500	11,300	- 800	214,050	213,600	+ 450
(543 mls.)						
" " goods ...	8,400	9,100	- 700	209,150	228,200	- 19,050
" " total ...	18,900	20,400	- 1,500	423,200	441,800	- 18,600
Great Southern (2,076 mls.) pass. ...	37,705	37,853	- 148	738,177	726,004	+ 12,173
" " goods ...	39,189	38,706	+ 483	943,108	1,003,032	- 59,924
" " total ...	76,894	76,559	+ 335	1,681,285	1,729,036	- 47,751

* 51st week (before pooling)

British and Irish Railway Stocks and Shares

Stocks	Highest 1937	Lowest 1937	Prices	
			June 22, 1938	Rise, Fall
G.W.R.				
Cons. Ord. ...	67½	55½	47½	+1¼
5% Con. Prefce. ...	127	108	108½	-1
5% Red. Pref. (1950) ...	113	109	109½	-
4% Deb. ...	113½	102½	106*	-2
4½% Deb. ...	118	106	109½*	-2
4½% Deb. ...	124½	112	115½*	-2
5% Deb. ...	136½	122¾	127*	-2½
2½% Deb. ...	76	64	66½*	-2
5% Rt. Charge ...	1337½	118	125½*	-2
5% Cons. Guar. ...	133¾	116½	124½	-1
L.M.S.R.				
Ord. ...	361½	25½	17	+1
4% Prefce. (1923) ...	82½	65½	46½	+1½
4% Prefce. ...	92½	77¾	64½	+1½
5% Red. Pref. (1955) ...	107¾	102	93½	+1
4% Deb. ...	108	99½	100	-
5% Red. Deb. (1952) ...	117½	111	111½	-
4% Guar. ...	104	95½	96	-
L.N.E.R.				
5% Pref. Ord. ...	121½	6¾	5	+1¼
Def. Ord. ...	61¼	35½	27½	+1½
4% First Prefce. ...	79½	63	44½	+1½
4% Second Prefce. ...	31½	21	15	+1
5% Red. Pref. (1955) ...	101½	89¾	74	+1½
4% First Guar. ...	103	91½	85	-1
4% Second Guar. ...	97½	85½	76	-1½
3% Deb. ...	84½	74	73½	-1½
4% Deb. ...	107½	98½	99	-
5% Red. Deb. (1947) ...	113½	106½	109½	-
4½% Sinking Fund Red. Deb. ...	110½	105½	106	-
SOUTHERN				
Pref. Ord. ...	98½	83½	68	+3
Def. Ord. ...	27½	16¾	17½	+1½
5% Pref. ...	126½	105½	104½	-2
5% Red. Pref. (1964) ...	118	110¼	111½	-2
5% Guar. Prefce. ...	133½	116¾	115½	-
5% Red. Guar. Pref. (1957) ...	118½	111½	115	-
4% Deb. ...	112	101½	104	-
5% Deb. ...	135¾	123½	125½	-
4% Red. Deb. 1962-67 ...	113	105	106½	-
BELFAST & C.D.				
Ord. ...	5	4	4	-
FORTH BRIDGE				
4% Deb. ...	106	99½	99½*	-1
4% Guar. ...	105¼	99	99½*	-2
G. NORTHERN (IRELAND)				
Ord. ...	11	5	4½	-
G. SOUTHERN (IRELAND)				
Ord. ...	50	21½	20	-
Prefce. ...	61	34	20½	+1½
Guar. ...	94¾	69½	59½	-
Deb. ...	95	82½	72	-1
L.P.T.B.				
4½% "A" ...	123¾	110½	115½	-1½
5% "A" ...	135	121½	125½	-
4½% "T.F.A." ...	108¾	104	106	-
5% "B" ...	125	114½	116½	-
"C" ...	99¾	75	73½	-1½
MERSEY				
Ord. ...	42½	22	18	-1
4% Perp. Deb. ...	103	96¾	100	-
3% Perp. Deb. ...	77½	74½	74½	-
3% Perp. Prefce. ...	68¾	61¼	65	+1

* ex dividend

CONTRACTS AND TENDERS

New Coaches for L.N.E.R.

The L.N.E.R. has placed orders for a total of 72 non-vestibuled coaches divided as follow: Metropolitan-Cammell Carriage & Wagon Co. Ltd.: 42 coaches comprised of 21 twin sets; and Birmingham Railway Carriage & Wagon Co. Ltd.: 30 coaches comprised of 15 twin sets.

G. H. Sheffield & Co. (Engineers) Ltd. is to supply Sheffield-Twinberrow bogies for the two third class and brake coaches, and one inspection saloon which, as recorded on this page of last week's issue, have been ordered by the Crown Agents for the Colonies from the Metropolitan-Cammell Carriage & Wagon Co. Ltd. for service on the Gold Coast Government Railway.

Robert Stephenson & Hawthorns Limited has received an order from the Bengal-Nagpur Railway Administration for six superheated boilers for FTS class tank locomotives.

Matheson & Co. Ltd. has placed orders to the requirements of the Chinese Government Purchasing Commission under the King Kan Railway Loan Agreement, and to the inspection of Messrs. Sandberg, as follow:—

With British rail makers: 4,700 tons of 35 kg. per metre steel rails and 245 tons of fish-plates.

Guest, Keen & Nettlefolds Limited: 25 metric tons of fishbolts and nuts, and 150 metric tons of dogspikes.

Patent Shaft & Axletree Co. Ltd.: 32 sets of 1 in 10 points and crossings.

A. C. Bottomley & Co. has received an order from the Indian Stores Department for 418 cast steel, class A, locomotive coupled-wheel axleboxes.

W. & T. Avery Limited has received orders from the Indian Stores Department for two single-pendulum dial-indicating 60-ton railway weighbridges.

The Junagad State Railway Administration has placed the following orders to the inspection of Messrs. Robert White & Partners:—

H. J. Skelton & Co. Ltd.: 6 tons 17 cwt. of galvanised sheets.

John Walsh (Birmingham) Limited: 11 tons 6 cwt. of mild steel plate, sheets, and rounds.

Howell & Co. Ltd. has received orders from the Egyptian State Railways Administration for the supply of superheater flame tubes (Ref. No. E.S.R. 17,189, total value approximately £888, delivery f.o.b. Liverpool).

The Wellington Tube Works Limited has received orders from the Egyptian State Railways Administration for the supply of point rodding (Order No. 24,232, total cost, £427, delivery f.o.b. English port).

The South Indian Railway Administration has placed the following orders to the inspection of Messrs. Robert White & Partners:—

Samuel Fox & Co. Ltd.: 11 tons of Dunie mild steel bars.

Brown Bayley's Steel Works Limited: 12½ tons of Longstrand mild steel bars.

John Mowlem & Co. Ltd. has received a contract from the London Passenger Transport Board, of the total value of £100,000, for lengthening 12 platforms at Piccadilly Circus, Charing Cross, Oxford Circus, Waterloo, Trafalgar Square, and Regent's Park stations. This work will involve the lengthening of the station tunnels. The Bakerloo Line trains will, in future, consist of seven cars instead of six, and passengers to Queen's Park and Watford will benefit also from new design rolling stock having driving equipment beneath the floor, which arrangement gives one-fifth more passenger accommodation than that on existing tube stock.

The Hydraulic Coupling & Engineering Co. Ltd. has received an order for 12 further Vulcan-Sinclair fluid couplings for railcars of the Belgian National Railways, this making a total of 37 such couplings on order for the same railway.

The Bengal-Nagpur Railway Administration has placed orders with the Monkbridge Iron & Steel Co., for 750 steel carriage and wagon tyres, and with William Beardmore & Co. Ltd., for 1,000 steel carriage and wagon tyres.

The Crown Agents for the Colonies have recently placed the following orders:—

Ingersoll-Rand Co. Ltd.: Air compressors.

J. Baker & Bessemer Limited: Axles.

Cochran & Co. (Aman) Ltd.: Boilers.

Webster & Bennett Limited: Boring and turning mill.

Britannia Electrical Cable & Construction Co. Ltd.: Cable.

Edison Swan Cables Limited: Cable.

General Cable Manufacturing Co. Ltd.: Cable.

Siemens Bros. & Co. Ltd.: Cable.

British Copper Refiners Limited: Copper ingots.

R. A. Lister & Co. Ltd.: Diesel engines.

Ruston & Hornsby Limited: Electric installations.

General Electric Co. Ltd.: Electrical materials.

Baldwins Limited: Galvanised iron sheets.

T. White & Sons Ltd.: Grinding machines.

Churchill Machine Tool Co. Ltd.: Grinding machines.

J. Lang & Sons Ltd.: Lathe.

Morrison, Marshall & Hill: Lathe.

Yorkshire Copper Works Limited: Locomotive copper tubes.

R. Stephenson & Hawthorns Limited: Locomotive fireboxes and spares.

Whitehead Iron & Steel Co. Ltd.: Mild steel.

P. & W. Maclellan Limited: Mild steel plates.

A. Herbert Limited: Milling machine.

Rail Anchors Limited: Rail anchors.

United Steel Cos. Ltd.: Rails and fishplates.

D. Wickham & Co. Ltd.: Rail motor inspection cars.

Butler Machine Tool Co. Ltd.: Slotting machines.

Mather & Platt Limited: Spray cooler plant.

Colvilles Limited: Steel sleepers.

Baldwins Limited: Steel sheets.

Anderson Foundry Co. Ltd.: Steel sleepers.

Dawnays Limited: Steelwork.

Dorman, Long & Co. Ltd.: Steelwork.

Superheater Co. Ltd.: Superheater elements.

British Thomson-Houston Co. Ltd.: Switchboard extension.

Ferguson, Pailin Limited: Switchgear.

Steel, Peech & Tozer: Tyres.

Owen & Dyson Limited: Wheels and axles.

E. Illingworth & Co. (Bradford) Ltd.: Wool waste.

The Norwegian State Railways are reported to have ordered a 3,500-h.p. diesel-electric express locomotive from Germany. It is to be used on the Oslo-Bergen line.

Bochumer Verein, A.G., has received orders from the Madras & Southern Mahratta Railway Administration to the inspection of Messrs. Rendel, Palmer & Tritton for 1,430 helical springs and 106 volute springs.

P. & W. Maclellan Limited has received an order from the Egyptian State Railways Administration for the supply of mild steel (Order No. 1424, total price approximately £209 f.o.b. Antwerp/Rotterdam, for items 1 and 3, and English port for item 2).

Uddeholms General Agencies Limited has received orders from the Madras & Southern Mahratta Railways Administration, to the inspection of Messrs. Rendel, Palmer & Tritton, for 240 steel boiler tubes and 96 flue tubes to be manufactured in Sweden by Uddeholms A/B.

The Chief Controller of Stores, Indian Stores Department (Miscellaneous Section), Simla, invites tenders, receivable by August 9, for the supply of fog-signals required on a rate contract basis during the period November 1, 1938-October 31, 1939.

Tenders are invited by the Chief Controller of Stores, Indian Stores Department (Electrical Section), Simla, receivable by August 6, for the supply on an annual rate contract basis of general lighting, train lighting, locomotive head-light and cab, and other lamps required for India and Burma during the period November 1, 1938-October 31, 1939.

Tenders are invited by the Egyptian State Railways Administration, receivable at the General Management, Cairo station, by August 2, for the supply and erection of a new single-track swing bridge over the Giza canal at El-Lahoun, and for the supply of the mechanism for a temporary bridge.

Tenders are invited by the Egyptian State Railways Administration, receivable at the General Management, Cairo station, by July 19, for the supply of 271,800 kg. flat mild-steel bars.

Tenders are invited by the Egyptian State Railways Administration, receivable by July 9, at the office of the Superintendent of Stores, Saptieh, Cairo, for the supply of 89,000 kg. round mild steel.

Tenders are invited by the Egyptian State Railways Administration, receivable at the General Management, Cairo station, by July 2, for the supply of two high-speed heavy-duty electrically-driven floor grinders. Particulars of this enquiry may be obtained from the Chief Inspecting Engineer's Office, 41, Tothill Street, Westminster, S.W.1.

The Westinghouse Brake & Signal Co. Ltd. advises us that its northern representative, Mr. W. E. Wilkins, has had his telephone number changed to Ringway 3491.

OFFICIAL NOTICES

London and North Eastern Railway Company

NOTICE IS HEREBY GIVEN that the Directors have fixed 1st July, at the close of business, as the date for striking the Balances of the Company's Guaranteed, Preference and Ordinary Stocks. Interim Dividends declared for the half-year ending 30th June, 1938, will be payable only to the Stockholders whose names are registered in the books of the Company on the date so fixed.

Deeds of Transfer should, therefore, be lodged with the Registrar of the Company at Hamilton Buildings, Liverpool Street Station, London, E.C.2, before 5.0 p.m. on 1st July.

By Order,

P. J. DOWSETT,
Secretary.

Marylebone Station,
London, N.W.1.
20th June, 1938.

ADVERTISER, being intimately acquainted with Railway Companies, is open to represent firms having Engineering specialities, or other commodities applicable to the Locomotive, Carriage and Wagon, or Electrical Engineering Departments.—Box 216, c/o THE RAILWAY GAZETTE, 33, Tothill Street, London, S.W.1.

REQUIRED, experienced Railway Signalling and Telegraph Engineer for railways in Rhodesia. Age about 35. Candidates must have knowledge of the construction and maintenance of the following: telegraph and telephone lines; railway telegraph, telephone and phonopore instruments, including selector telephone system and automatic telephones; railway staff, tablet or key token instruments; railway signalling and interlocking. Candidates must be competent to supervise installation and maintenance of foregoing, to design layouts for stations and to prepare estimates of costs and bills of quantities for improvements, renewals and proposed new works. Three years' agreement. Commencing salary £600 per annum with annual increments of £25. Apply in writing, stating age, education, professional qualifications, full particulars of experience, married or single, and position now held, to Box 537, LEATHWAIT & SIMMONS, 1-4, Cophall Chambers, E.C.2.

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Bombay, Baroda & Central India Railway Company

THE Directors are prepared to receive up to Noon on Friday, 19th August, Tenders for the supply of:—

TWO OR FOUR STEEL MOTOR COACHES WITH FOUR WHEEL BOGIES, ELECTRICAL EQUIPMENT AND WHEELS AND AXLES.

Tenders must be made on forms, copies of which, with Specification, can be obtained at these offices on payment of 20s. each (which will not be returned).

The Directors do not bind themselves to accept the lowest or any Tender.

N. LINCOLN,
Secretary.

Offices:
The White Mansion,
91, Petty France,
Westminster, S.W.1.
21st June, 1938.

OFFICIAL ADVERTISEMENTS intended for insertion on this page should be sent in as early in the week as possible. The latest time for receiving official advertisements for this page for the current week's issue is noon on Thursday. All advertisements should be addressed to:—The Railway Gazette, 33, Tothill Street, Westminster, London, S.W.1.

RAILWAY AND OTHER REPORTS

Leopoldina Terminal Co. Ltd.—

After providing £14,440 for taxation there was a loss for the year 1937 of £452. The charges in respect of the service of the 5 per cent. first debentures amount to £70,426, which amount is receivable from the Leopoldina Railway Co. Ltd., at the expiration of the moratorium period of two years from and including January 1, 1937, which moratorium in certain events may be extended for a further period of one, two, or three years. Net receipts from working the combined system of the Cantareira Company were in 1937 1,489,170 milreis, a decrease of 278,553 milreis in comparison with 1936. Gross receipts improved by 652 contos, but working expenses increased by 931 contos, mainly due to increased costs in labour, fuel, and materials.

Ribble Motor Services Limited.—

For the year ended March 31, 1938, this company, which is controlled jointly by the L.M.S.R. Company and Tilling & British Automobile Traction Limited, secured a total revenue of £1,544,923, against £1,396,609 for the previous year. After deducting all expenses, including £194,000 (against £191,000) charged to depreciation reserve, there remains a balance of £142,115 (against £150,315) which, added to £31,477 brought forward, makes a total of £173,592. Of this amount £40,000 is again allocated to reserve and £13,000 to preference dividend. The dividend of 10 per cent. recommended for the year on the ordinary shares again takes £80,000, leaving £40,592 to be carried forward. The company has acquired the road passenger businesses of J. T. Harrison and Sidney Snape and, jointly with other operators with whom it has working arrangements, that of Lewis Cronshaw Limited. The new head offices at

Preston have been completed, and a bus station has been erected at Great Crosby.

Southdown Motor Services Limited.—

For the year ended March 31, 1938, this company, which is jointly controlled by the Southern Railway Company and Tilling & British Automobile Traction Limited, secured a gross revenue of £981,908, compared with £951,067 in the previous year. After deducting £529,739 (£501,845) for operating and maintenance expenses, £164,922 (£153,956) for Road Act duties, rates, and taxes, £58,202 (£55,391) for administration and general expenses, £140,559 (£143,186) for depreciation, and other items chargeable against revenue, there remains a profit of £85,543 (£85,391), to which must be added £18,484 brought forward, making a total of £104,027, compared with £103,484 for the previous year. Out of this amount, it is proposed again to place £10,000 to reserve, to pay, as in the previous year, a dividend of 10 per cent., requiring £75,000, and to carry forward £19,027.

General Electric Co. Ltd.—

Profits for the year ended March 31, 1938, amounted to £1,772,181 (against £1,604,512), and adding £749,294 brought forward, gave a total of £2,521,475. After deducting £368,642 for depreciation, directors' remuneration £4,287, pension fund £54,008, appropriating £400,000 to taxation reserve and £100,000 to reserve account, and paying preference dividends amounting to £185,840, there remains an available balance of £1,408,698. The directors recommend a dividend on the ordinary stock of 10 per cent. for the year (£304,382) and a bonus of 10 per cent. (£304,382), leaving £799,934 to be

carried forward. For the previous year the dividend was 10 per cent., and the bonus 7½ per cent. Results of the year's trading constitute a fresh record. The works have been fully employed and the recent extensions have enabled a greater output to be secured. This activity is due mainly to general and domestic demand. The volume of shipments overseas has considerably exceeded that of any previous year. In South Africa, Australia, India, New Zealand, Malaya, and Argentina, the branch companies have enjoyed a successful year's trading.

Keith Blackman Limited.—

The report for the year ended March 31, 1938, shows an available balance standing at the credit of profit and loss account, after providing for preference dividend, depreciation, reserves against doubtful debts, and income tax and N.D.C., of £62,803, which compares with £58,416 for the previous year. The dividend recommended on the ordinary shares is again 20 per cent., requiring £30,812, being for 12 months on 400,000 ordinary shares of 10s. each, and for three months on 100,000 new ordinary shares of 10s. each, leaving £31,991 to be carried forward, against £13,416 brought in. The amount of business done considerably exceeded that of the previous year. Satisfactory progress has been made with the erection of the new works and offices at Mill Mead Road, Tottenham, and production has commenced in the plate work section.

Forthcoming Meetings

June 29 (Wed.)—Mexican Railway Co. Ltd. (Ordinary General), Winchester House, Old Broad Street, E.C., at 2.30 p.m.

July 15 (Fri.)—Chemin de fer de Charleroi à la Frontière de France (Ordinary General), Charleroi, at the company's headquarters (Bureau de l'Exploitation Nord-Belge) at 12.15 p.m.

Railway Share Market

The general position of the stock and share markets has undergone a change for the better since the beginning of the new Stock Exchange account on Monday. No material improvement in the volume of business was in evidence, but prices in most sections showed a fairly general rally. Sentiment was influenced by expectations of improvement in the European political situation, and dealers sent out higher prices as a precautionary measure, because the floating supply of leading securities is small, despite the steady fall in values in recent months, and it is assumed that strong demand would develop if hopes regarding international affairs were borne out in the near future. The higher prices of commodities and metals and the firmer tone of Wall Street markets were also helpful factors.

Home railway stocks participated in the improved tendency and, with few exceptions, the junior securities made better prices this week, although very little de-

mand was in evidence. The further decline in traffic shown by the past week's return and a widespread disposition to await next month's half-yearly statements induced prospective buyers to continue to adopt a waiting policy. Great Western ordinary improved to 47½, aided by the continued assumption that a dividend of at least 3 per cent. can be expected this year. Southern preferred moved up to 67½ and was rather more active in view of the large yield, while the deferred stock also improved and changed hands up to 17½ at one time. L.M.S.R. ordinary was better at slightly over 17, while there were larger inquiries in evidence for the 1923 preference and 4 per cent. preference, which show gains to 46½ and 64 respectively. L.N.E.R. first preference also had an improved tendency at 44½. As in the case of L.M.S.R. preference stocks, the view has gained ground that, having regard to all the circumstances, the yield obtainable seems attractive. Nevertheless,

the main factor influencing the better prices made this week was the more cheerful tone of markets generally. L.N.E.R. second preference transferred around 15. Debenture and guaranteed stocks were steadier. In other directions, London Transport "C" stock was lower at 73½ despite the moderate traffic gain last week and the assumption that there are grounds for expecting that the full 5½ per cent. dividend due this year will be paid even if it necessitates a transfer from reserve.

Foreign railway securities were not particularly active and there were few movements of importance. On balance the ordinary stocks of the B.A. Great Southern and other leading Argentine railways were inclined to improve, but preference and debenture stocks were relatively dull. Cordoba Central first debenture received some attention, while a fair amount of business was reported in Nitrate Rails, but San Paulo was lower. Canadian Pacific shares were better at 5½.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

Railways	Miles open 1937-38	Week Ending	Traffic for Week		No. of Weeks	Aggregate Traffic to Date			Shares or Stock	Prices						
			Total this year	Inc. or Dec. compared with 1937		Totals		Increase or Decrease		Highest 1937	Lowest 1937	June 22, 1938	Yield % (See Note)			
						This Year	Last Year									
			£	£		£	£	£								
Antofagasta (Chili) & Bolivia	834	19.6.38	10,350	-	6,670	25	399,840	413,630	-	13,790	Ord. Stk.	29	101½	91½	Nil	
Argentine North Eastern	753	18.6.38	12,785	+	564	51	474,149	454,744	+	19,405		1914	60	90	47½	
Argentine Transandine											A. Deb.	95½	60	90	47½	
Bolivar	174	May, 1938	3,450	-	2,650	22	19,050	29,300	-	10,250	6 p.c. Deb.	91½	5	8½	Nil	
Brazil											Bonds.	17	9	5	10	
Buenos Ayres & Pacific	2,806	18.6.38	78,164	-	18,176	51	4,482,265	4,917,475	-	435,210	Ord. Stk.	171½	51½	5	Nil	
Buenos Ayres Central	190	4.6.38	\$116,700	-	\$56,100	49	\$5,568,400	\$6,844,600	-	\$1,276,200	Mt. Deb.	411½	18	111½	Nil	
Buenos Ayres Gt. Southern	5,084	18.6.38	116,935	+	558	51	7,527,044	7,543,877	-	16,833	Ord. Stk.	335½	131½	12	Nil	
Buenos Ayres Western	1,930	18.6.38	35,546	-	7,444	51	2,282,196	2,540,277	-	258,081	"	314½	114	8	Nil	
Central Argentine	3,700	18.6.38	99,442	-	57,044	51	6,036,822	7,830,083	-	1,793,291	"	344	103½	8½	Nil	
Do.											Dfd.	201½	41½	4	Nil	
Cent. Uruguay of M. Video	972	11.6.38	19,598	+	160	50	924,120	897,151	+	26,969	Ord. Stk.	67½	2	2	Nil	
Cordoba Central	1,218										Ord. Inc.	61½	11½	3	Nil	
Costa Rica	188	Apr., 1938	27,588	+	6,911	44	260,926	192,328	+	68,598	Stk.	38	27	26½	79½	
Dorada	70	May, 1938	18,300	+	4,300	22	79,200	76,400	+	2,800	1 Mt. Db.	107	106	104½	55½	
Entre Rios	810	18.6.38	14,782	-		51	729,171	688,545	+	70,626	Ord. Stk.	191½	6	5	Nil	
Great Western of Brazil	1,092	18.6.38	5,200	-	1,490	25	173,800	186,500	-	12,700	Ord. Sh.	34	18	14	Nil	
International of Cl. Amer.	794	Apr., 1938	\$523,864	-	\$37,036	18	\$2,056,786	\$2,181,008	-	\$124,222						
Interoceanic of Mexico											1st Pref.	2/-	1/-	1½	Nil	
La Guaira & Caracas	22½	May, 1938	5,905	+	650	22	25,635	28,335	-	2,700	Stk.	81½	6	8½	2	Nil
Leopoldina	1,918	18.6.38	17,456	+	4,824	25	442,569	542,238	-	99,669	Ord. Stk.	91½	3	2	Nil	
Mexican	483	14.6.38	\$268,300	+	\$19,100	24	\$7,222,200	\$7,309,100	-	\$86,900	"	112	14	5½	Nil	
Midland of Uruguay	319	May, 1938	8,322	-	153	48	104,249	86,221	+	8,028	"	178	12	12	Nil	
Nitrate	386	15.6.38	5,661	-	53	24	78,687	80,419	-	1,732	Ord. Sh.	31½	2	2	5	
Paraguay Central	274	11.6.38	\$4,647,000	+	\$404,000	50	\$163,579,000	\$151,563,000	+	\$12,016,000	Pr. Li. Stk.	84	79½	621½	95½	
Peruvian Corporation	1,059	May, 1938	68,538	-	11,718	48	879,402	908,145	-	28,743	Pref.	145½	41½	21½	Nil	
Salvador	100	11.6.38	£15,100	-	£7,550	50	£971,895	£1,202,008	-	£230,113	Pr. Li. Db.	231½	21½	22½	Nil	
San Paulo	153½	12.6.38	33,804	-	5,085	24	730,876	756,778	-	25,902	Ord. Sh.	981½	56	36	111½	
Taita	160	May, 1938	1,820	-	1,490	48	36,805	37,920	-	1,115	Ord. Stk.	171½	111½	84	139½	
United of Havana	1,353	18.6.38	18,465	-	1,845	51	1,239,713	1,372,583	-	132,870	Ord. Stk.	58½	31½	2	Nil	
Uruguay Northern	73	May, 1938	851	+	128	48	10,331	10,856	-	525	Deb. Stk.	10	2	2	Nil	
Canada	23,781	14.6.38	709,321	-	96,604	24	15,051,729	17,236,630	-	2,184,901						
Canadian National											Perp. Dbs.	77	621½	621½	65½	
Canadian Northern											4 p.c. Gar.	1017½	941½	1021½	37½	
Grand Trunk											Ord. Stk.	18	71½	51½	Nil	
Canadian Pacific	17,186	14.6.38	441,600	-	79,800	24	11,126,000	12,110,600	-	984,600						
India†	1,329	31.5.38	39,810	+	1,503	9	221,640	215,332	+	6,108	Ord. Stk.	86	73½	79	31½	
Barsi Light	202	31.5.38	3,345	+	263	9	24,840	22,312	+	2,528	Ord. Sh.	661½	46	60	85½	
Bengal & North Western	2,116	10.6.38	84,187	+	45	10	624,262	662,609	-	38,347	Ord. Stk.	317	301	291½	65½	
Bengal Doonars & Extension	161	10.6.38	3,624	-	5	10	24,349	23,306	+	1,043	"	100	84	85½	7	
Bengal-Nagpur	3,268	31.5.38	227,775	-	10,602	9	1,227,450	1,275,032	-	47,582	"	101	89	90½	47½	
Bombay, Baroda & Cl. India	3,072	10.6.38	253,575	-	12,825	10	1,951,725	1,995,825	-	44,100	"	113	110½	110½	57½	
Madras & Southern Mahratta	2,967	31.5.38	188,325	+	2,838	9	1,007,325	988,485	+	18,840	"	110	105	107	87½	
Rohilkund & Kumaon	571	10.6.38	16,941	-	1,067	10	129,592	131,941	-	2,349	"	314	302	304½	51½	
South Indian	2,531½	20.5.38	123,064	+	5,330	7	589,093	594,375	-	5,292	"	103½	99½	101½	41½	
Various	204	Apr., 1938	80,098	-	2,647	31	608,686	501,230	+	107,456						
Egyptian Delta	620	31.5.38	5,562	-	266	9	33,910	34,459	-	549	Prf. Sh.	31/-	84	34	Nil	
Kenya & Uganda	1,625	May, 1938	219,888	+	5,337	22	1,281,351	1,336,076	-	54,725						
Manila											B. Deb	481½	431½	42	85½	
Midland of W. Australia	277	Apr., 1938	16,585	+	3,533	44	147,590	132,650	+	14,940	Inc. Deb.	98	931½	931½	41½	
Nigerian	1,900	30.4.38	27,850	-	30,927	5	136,854	314,220	-	177,366						
Rhodesia	2,442	Apr., 1938	394,424	-	16,169	31	2,906,452	2,520,488	+	385,964						
South Africa	13,263	28.5.38	557,806	-	46,288	9	4,993,490	5,107,908	-	114,418						
Victoria	4,774	Mar., 1938	902,439	-	25,935	39	7,294,911	7,634,217	-	339,306						

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1½

† Receipts are calculated @ 1s. 6d. to the rupee. ‡ ex dividend.

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the Sterling weekly receipts at the par rate of exchange has proved misleading, the amount being overestimated. The statements are based on the current rates of exchange and not on the par value

Electric Railway Traction

Mid-Sussex and Sussex Coast Electrification, Southern Railway

BEFORE the 1923 grouping, Sussex was always the particular preserve of the London Brighton & South Coast Railway, and all the lines just electrified under the Portsmouth No. 2 scheme, *viz.*, Dorking—Horsham—Ford—Havant, Three Bridges—Horsham, Worthing—Ford, and the Bognor and Littlehampton branches, were built, or operated from the beginning, by that railway. The oldest section, immediately to the west of Shoreham, was opened in 1846, but well before that time Vignoles had surveyed, on the instructions of Rennie, a line from Nine Elms through Dorking and Horsham to Shoreham and Brighton, and also a coastal line from Shoreham to Portsmouth. Together with a proposed line from Kennington to Croydon and Brighton, these routes were intended to form the nucleus of the Surrey, Sussex, Hants, Wilts & Somerset Railway, which, if it had got as far as its title suggested, might have meant a little less amalgamation in 1923. Robert Stephenson also surveyed in the 1830's a route from Wimbledon through Horsham to Shoreham. Westward along the coast, the railway which actually came to be built was projected by the Brighton & Chichester Railway, incorporated on July 4, 1844, and by the same Act empowered to sell its line to the London & Brighton Railway, which at that time comprised only the main line to Brighton and the branch to Shoreham. The sale was duly carried out in August, 1845, when the L. & B. gave a premium of £12 10s. a share on the 4,520 £50 shares, thus paying a premium of £56,500, or 25 per cent.

Meanwhile, by its Act of August 3, 1845, the Brighton & Chichester Railway had received Parliamentary sanction to make an extension to Portsmouth which might be sold on completion to the L. & B. The B. & C. Company therefore retained its corporate existence as the proprietor of the extension works, as the sale could not legally be completed until the line was opened, but the existence was merely nominal, for the works were carried out, and the money for them paid, by the L. & B. The openings were: Shoreham—Worthing on November 24, 1845; Worthing—"Littlehampton" (station at Lyminster), March 18, 1846; and "Littlehampton"—Chichester (including Ford drawbridge), June 9, 1846. Although built as a double-track line, the Worthing—Lyminster section was worked as single track until 1847. The Lyminster—Chichester section was at first built as single track. Between "Littlehampton" (Lyminster) and Ford drawbridge the original route was somewhat to the south of the present one, as indicated by a small map in the Civil Engineering section of this Supplement. At a later date Lyminster (some early accounts called it Leominster) station was named "Arundel and Littlehampton," and it was closed when the Littlehampton branch was opened in 1863. The extension from Chichester to Havant was opened on March 15, 1847, and from Havant to Portsmouth on June 14, 1847, but subse-

quently the section from Portcreek junction to Portsmouth became a joint line of the L.B.S.C.R. and the L.S.W.R. By Act of July 11, 1861, the Bognor Railway Company was incorporated; it opened the line from Barnham junction to Bognor on June 1, 1864, but was absorbed by the L.B.S.C.R. by an Act of July 29, 1864, the actual taking over being effected in October of the same year. Bognor has now added the dignity of "Regis" to its name, but in the pre-railway era it was known as "Hothampton." Originally Barnham station was named "Bognor." The Littlehampton branch from Ford was opened on August 17, 1863, but it was not until January 1, 1887, that the loop from Arundel junction was opened, at the same time as the deviation of the coast line was carried out. Further north the "Brighton" opened the Three Bridges—Horsham line on February 14, 1848, and the Dorking—Horsham section on May 1, 1867. The Mid-Sussex Railway was incorporated by Act of August 10, 1857, to build a line from Horsham to Pulborough and Petworth, which was opened on October 15, 1859. It was purchased by the L.B.S.C.R. on May 31, 1860, and the Petworth line was extended to Midhurst. Finally, the Pulborough—Arundel junction line was opened on August 3, 1867.

The conversion of these Sussex lines under the Portsmouth No. 2 scheme, comprises the electrification on the 600-volt d.c. third-rail system of 75 route and 165 track miles, which is to be opened officially on June 30, 1938, with a regular electric service beginning on July 2. Electrification has been carried out at a cost of approximately £2,750,000 in connection with the Government guarantee scheme, and under the ægis of Sir Herbert Walker, the work having been brought to completion under the present General Manager, Mr. G. S. Szlumper. As with the previous main line conversions, the present scheme was prepared and carried out by Mr. Alfred Raworth, the company's Electrical Engineer for New Works, and that gentleman has been responsible also for the design, layout, and installation of the whole of the electrical equipment. The rolling stock, apart from the electrical equipment, which came under Mr. Raworth's jurisdiction, was designed by Mr. R. E. L. Maunsell, and, more particularly the buffet cars, his successor, Mr. O. V. Bulleid, the present Chief Mechanical Engineer. The many civil engineering works, including the signalling and the laying of the conductor rails and the erection of the substation buildings, have been undertaken by Mr. George Ellson, the Chief Engineer. The greatly increased traffic facilities, including a virtual doubling of the train mileage, standardised timings, and accelerated schedules, were prepared by Mr. E. J. Missenden, the Traffic Manager, and his staff, and having got a good thing, the Southern Railway, under the direction of Mr. C. Grasemann, the Public Relations and Advertising Officer, is now telling the public about it.

Traffic Operation



Standardised timetables have always been a feature of the Southern electric services, both on the main and suburban lines. With the more recent extensions (Eastbourne and Hastings in 1935 and Portsmouth Direct in 1937) a number of operating problems presented themselves in the coastal area, where trains from various directions crossed or passed each other, but in no case has the compilation of satisfactory timetables been more difficult than on the Mid-Sussex and Sussex coast lines, where all the main line trains and many of the locals must make connections and clear other trains at three or four different points without upsetting existing electric schedules on other routes.

Taken generally, the main line services are improved principally by acceleration and by an increase in the number of through trains, rather than by the total number of trains. On the local services there has been a great increase under all three headings. A total of 4,015,194 electric train miles a year has replaced 2,051,655 steam train miles, representing an increase of over 95 per cent., but additional steam train miles aggregating 23,400 miles will be run on adjacent steam worked lines in order to give more frequent services in connection with the electric trains. For the fast trains a four-car vestibuled set is the basic unit, from which are built up eight-car and twelve-car trains as required. Some of these four-car units include a buffet car. Local trains are made up of one or more twin-car sets, some of which are of the non-vestibuled corridor pattern. A total of 292 new carriages has been provided.

Through Train Timetables

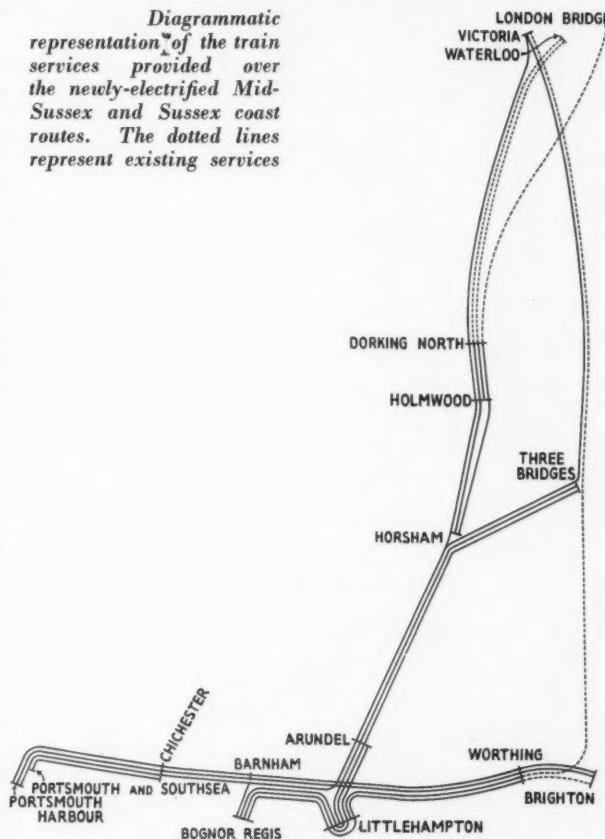
The basic feature of the through services is an hourly service of fast trains from London to the principal places served, viz., Horsham, Pulborough, Arundel, Littlehampton, Bognor Regis, Chichester and Portsmouth. Those to Littlehampton are routed *via* the Brighton main line as far as Preston Park; the other hourly service caters for all the places just mentioned and runs from Victoria *via* Horsham and down the Mid-Sussex line.

An improvement in the service to the area west of Worthing has been effected by extending the London-Worthing trains leaving Victoria at 25 min. past the hour from 9.25 a.m. to 10.25 p.m. to Littlehampton, calling *en route*, after West Worthing, at Durrington, Goring, and Angmering. In the up direction the trains leave Littlehampton every hour from 8.9 a.m. to 8.9 p.m. Additional fast trains are run during the business hours, and in general these are faster than the standard 1½-hour timing of the hourly service. For example, the 5.6 p.m. down from London Bridge takes only 90 min., an acceleration of 22 min. over the steam timing, and gives a through journey in place of changes at West Worthing and Ford. Similarly, the 6.5 p.m. down is accelerated by 14 min., and an entirely new service is given at 5.45 p.m. from London Bridge. By using the London to Bognor Regis and Portsmouth trains and changing at Arundel, a second set of hourly services is available to Littlehampton passengers.

The West Sussex area is served by down trains leaving Victoria hourly from 8.18 a.m. to 9.18 p.m. and up trains leaving Portsmouth Harbour at the same interval from 8.23 a.m. to 8.23 p.m., and calling at Horsham, Pulborough, Arundel, Barnham, Chichester, Havant, and Fratton. At Barnham a portion is detached for, or

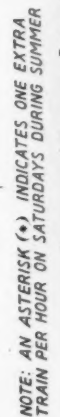
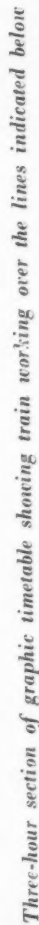
attached from, Bognor Regis, the down portions reaching Bognor Regis at the even hour, *i.e.*, 102 min. after leaving Victoria, and the up portions leaving Bognor Regis at 55 min. past each hour. These timings were governed not only by workings in the London area, but also by the necessity of dovetailing between Havant and Portsmouth with the express and stopping trains to and from Waterloo over the Portsmouth direct route. Certain of the trains in this series will run between Victoria and Horsham *via* Croydon and Three Bridges, and the remainder *via* Sutton

Diagrammatic representation of the train services provided over the newly-electrified Mid-Sussex and Sussex coast routes. The dotted lines represent existing services



and Dorking North, where they will call and connect with local trains; thus a service by each of the alternative routes will be maintained.

During the business hours, to give services with quicker journey times, the departures from the coast are Bognor Regis 7.5 a.m. (a new train); Portsmouth Harbour 7.18 a.m. (with a portion from Bognor Regis at 7.55) and Bognor Regis 8.28 to London Bridge, the latter service being accelerated 14 min. Similarly, in the down direction the departures from London after 5.0 p.m. will be 5.15 p.m. from London Bridge; 5.30 p.m. from Victoria (a new train); 5.48 p.m. from London Bridge; and the 6.18 p.m. from Victoria leaving at standard time will arrive Bognor Regis at 7.45 p.m., an acceleration of 12 min. On Saturdays during the summer there will be an additional express train from Victoria to Bognor Regis running *via* the Mid-Sussex line and Littlehampton, leav-



Layout of lines and traffic density through Barnham, Ford, Arundel, and Lutterhampton junctions

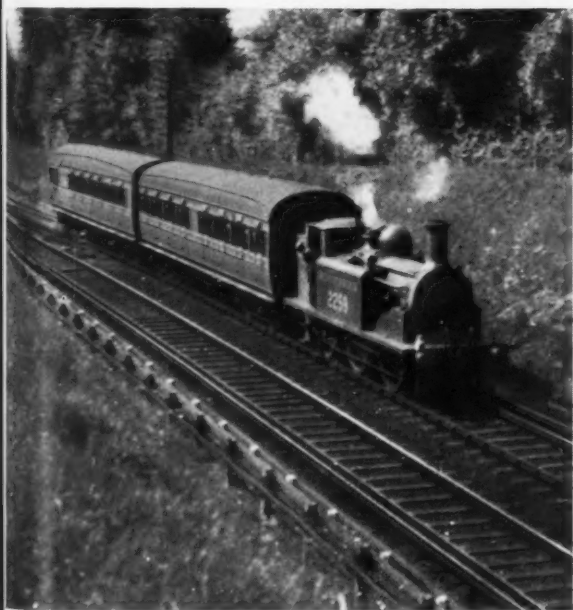
ing Victoria at 48 min. past the hour from 8.48 a.m. to 3.48 p.m. with a corresponding up service leaving Bognor Regis at 22 min. past each hour from 10.22 a.m. to 5.22 p.m.

Semi-Fast and Stopping Trains

At 47 min. past the hour from 6.47 a.m. to 10.47 p.m. a semi-fast train will leave Brighton for Portsmouth Harbour, calling *en route* at Hove, Shoreham, Worthing Central, Barnham, Chichester, Havant, Fratton, and Portsmouth & Southsea. The return services from Portsmouth Harbour begin at 6.53 a.m., and continue hourly until 9.53 p.m. This service is supplemented by stopping trains leaving Brighton at 17 min. past the hour from 6.17 a.m. to 10.17 p.m., and Portsmouth at 10 min. past the hour from 6.10 a.m. to 10.10 p.m., which call at Hove, Shoreham, Worthing and all intermediate stations and halts except Durrington and Bedhampton Halt.

In addition to the Brighton—Portsmouth services, still further stopping trains are provided over the whole coast line except between Barnham and Chichester. To the east of this, the service is given by extending the present Brighton and West Worthing stopping trains to Bognor Regis *via* Littlehampton, leaving Brighton at 50 min. past the hour from 5.50 a.m. to 10.50 p.m., and from Bognor Regis 9.30 a.m. to 9.30 p.m., and then at 10.2 p.m. and 11.14 p.m. To cover existing business hour services additional trains leave Bognor Regis at 5.40 a.m., 7.35 a.m., and 8.14 a.m. At the west end, there is an hourly shuttle service between Chichester and Portsmouth, leaving Chichester from 7.37 a.m. to 10.37 p.m., and Portsmouth & Southsea from 9.42 a.m. to 9.42 p.m., and stopping at all stations and halts. Additional trains will be run to maintain existing early morning business services.

From Three Bridges a stopping train runs to Littlehampton each hour, calling at all stations and halts, and connecting with the London—Brighton semi-fast and stopping services at Three Bridges, from which station the departure times are 47 min. past the hour from 6.47 a.m. to 8.47 p.m. In the reverse direction the departure from Littlehampton is every hour from 8.59 a.m. to 8.59 p.m.



One of the push-and-pull two-car local trains hauled by ex-L.B.S.C.R. D-class 0-4-2T engines which operated the local services before electrification



Local services are now worked by two-car electric trains

By the same route another hourly stopping service is provided, leaving Three Bridges at 17 min. past the hour, from 7.17 a.m. to 10.17 p.m., but after reaching Littlehampton this service is continued to Bognor Regis. The return service is from Bognor Regis at 10 min. past the hour from 9.10 a.m. to 9.10 p.m. Additional trains will run to maintain early morning business trains and late services. Over the Mid-Sussex line between Horsham and Arundel there are thus one express and two stopping trains an hour in each direction, with an additional express service on Saturdays, and there is a further shuttle service of one train an hour between Arundel and Bognor Regis *via* Littlehampton which connects with the hourly fast train, so that Littlehampton can be reached in quick time either by the direct trains *via* Haywards Heath or by the fast Bognor Regis and Portsmouth trains running over the Mid-Sussex line. A corresponding service is worked in the opposite direction, connecting with the up London train at Arundel.

Finally, the London—Dorking suburban services have been extended south. One train each hour from Waterloo to Dorking North and one train each hour from London Bridge to Dorking North have been extended south to Horsham, and sandwiched between these two is an extension of one of the Waterloo workings as far as Holmwood. Horsham thus has a service of one fast and three stopping trains an hour to and from London.

Connections

The connections given from the Mid-Sussex fast trains to local and other stations may be exemplified by tracing one of the standard down trains between London and Portsmouth. The standard 18 min. past the hour trains from Victoria stop at Dorking North at 55 min. past the hour; Horsham at 13 min. and Arundel at 40 min. past the next hour. The Waterloo to Horsham stopping service arrives at Dorking North 4 min. in front and leaves 5 min. behind the trunk train, thus providing a double connection.

At Arundel the stopping service from Three Bridges to Littlehampton arrives 4 min. before the fast train giving a connection to it from intermediate stations; whilst three minutes after its departure, the local connection leaves for Littlehampton. Five minutes after the express has left Barnham for Portsmouth, it is followed by a stopping train which has left Brighton at 17 min. past the hour, and which serves all stations and halts except

WEEKDAY SUMMER SERVICES

Between	Steam		Electric		Percentage Increase in Through Services
	No. of Services	No. of Through Services	No. of Services	No. of Through Services	
London and Arundel ..	14	12	26	17	42
Arundel and London ..	15	14	18	16	14
London and Littlehampton ..	27	1	42	18	1,700
Littlehampton and London ..	31	Nil	33	15	2
London and Bognor Regis ..	19	8	19	16	100
Bognor Regis and London ..	21	9	20	16	78
London and Chichester ..	15	10	17	15	50
Chichester and London ..	18	8	20	14	75
Brighton and Littlehampton ..	34	1	38	18	1,700
Littlehampton and Brighton ..	33	Nil	34	19	2
Brighton and Bognor Regis ..	28	1	51	17	1,600
Bognor Regis and Brighton ..	31	Nil	48	16	2
Brighton and Chichester ..	22	17	38	36	112
Chichester and Brighton ..	22	16	36	36	125
Brighton and Portsmouth ..	19	15	35	33	120
Portsmouth and Brighton ..	16	12	33	33	175
London and Portsmouth ..	13	10	17	16	60
Portsmouth and London ..	11	8	17	14	75

WEEKDAY SUMMER SERVICES FROM LONDON, ACCELERATION

	Electric trains, min.	Steam trains, min.	Gain, per cent.
Arundel ..	89	105 av.	15
Littlehampton ..	102	116 av.	12
Bognor Regis ..	105	128 av.	18
Chichester ..	103	127 av.	18

WEEKDAY SUMMER SERVICES ALONG THE COAST, ACCELERATION

	Electric trains, min.	Steam trains, min.	Gain, per cent.
Brighton to Littlehampton ..	43	56	23
Brighton to Bognor Regis ..	54	63	14
Brighton to Chichester ..	49	62	21
Brighton to Portsmouth ..	78	96	19

Head Codes, Portsmouth No. 2 Electrification, Central Section

Service	Route	Class of Train	Route Indication	Service	Route	Class of Train	Route Indication
Victoria and Portsmouth Harbour	Mitcham Junction ..	Passenger	20	London Bridge and Littlehampton (via Horsham)	Mitcham Junction ..	Passenger	51
	Quarry & Horsham ..	do.	26		Quarry & Horsham ..	do.	53
	Redhill & Horsham ..	do.	28		West Croydon ..	do.	57
Victoria and Portsmouth Harbour (via Littlehampton)	Mitcham Junction & Littlehampton ..	do.	70		Redhill & Horsham ..	do.	59
	Quarry, Horsham & Littlehampton ..	do.	76	Three Bridges and Horsham	—	do.	2
	Redhill, Horsham & Littlehampton ..	do.	78		Three Bridges or Horsham and Littlehampton ..	do.	5
Victoria and Bognor Regis	Mitcham Junction ..	do.	40	Three Bridges or Horsham and Bognor Regis	Direct ..	do.	6
	Quarry & Horsham ..	do.	46		Littlehampton ..	do.	7
	Redhill & Horsham ..	do.	48	Arundel & Littlehampton	—	do.	1
Victoria and Bognor Regis (via Littlehampton)	Mitcham Junction & Littlehampton ..	do.	90		Arundel and Bognor Regis	Direct ..	4
	Quarry, Horsham & Littlehampton ..	do.	96	Brighton and West Worthing	Littlehampton ..	do.	3
	Redhill, Horsham & Littlehampton ..	do.	98		Direct ..	do.	1
Victoria and Littlehampton (via Worthing)	Quarry & Worthing ..	do.	16	Brighton and Littlehampton	Preston Park ..	do.	32
	Redhill & Worthing ..	do.	18		—	do.	35
Victoria and Littlehampton (via Horsham)	Mitcham Junction ..	do.	50	Brighton and Bognor Regis	Direct ..	do.	64
	Quarry & Horsham ..	do.	56		Littlehampton ..	do.	31
London Bridge and Portsmouth Harbour	Redhill & Horsham ..	do.	58	Brighton and Portsmouth Harbour	Direct ..	Semi-fast passenger	60
	Mitcham Junction ..	do.	21		Direct ..	Slow passenger	62
	Quarry & Horsham ..	do.	23	Bognor Regis and Barnham	Littlehampton ..	Passenger	30
London Bridge and Portsmouth Harbour (via Littlehampton)	Redhill & Horsham ..	do.	25		—	do.	1
	Mitcham Junction & Littlehampton ..	do.	71	Bognor Regis and Portsmouth Hbr.	—	do.	12
	Quarry, Horsham & Littlehampton ..	do.	73		Littlehampton, Barnham and Portsmouth (Low Level)	do.	13
London Bridge and Bognor Regis	Redhill, Horsham & Littlehampton ..	do.	75	Chichester and Portsmouth (Low Level)	—	do.	15
	Mitcham Junction ..	do.	41		Waterloo and Horsham	do.	1
	Quarry & Horsham ..	do.	43	London Bridge and Horsham	—	do.	L
London Bridge and Bognor Regis (via Littlehampton)	Redhill & Horsham ..	do.	45		Mitcham Junction ..	do.	A
	West Croydon ..	do.	47				
	Mitcham Junction & Littlehampton ..	do.	91				
London Bridge and Bognor Regis (via Littlehampton)	Quarry, Horsham & Littlehampton ..	do.	93				
	Redhill, Horsham & Littlehampton ..	do.	95				
	Quarry & Worthing ..	do.	17				
London Bridge and Littlehampton (via Worthing)	Redhill & Worthing ..	do.	19				

Empty trains between West Worthing, Lancing, Hove and Lovers' Walk via Preston Park do not carry any route indicator. All other empty electric trains carry the relevant route indicator with a bar over it

Bedhampton thence to Portsmouth Harbour, whereas the fast train stops only at Chichester, Havant, Fratton, and Portsmouth & Southsea. Passengers from intermediate stations between Worthing Central and Ford, including Littlehampton, arrive at Barnham 4 min. before the trunk train, using the stopping Bognor Regis service leaving Brighton at 50 min. past the hour, and can transfer at Barnham to the fast train or to the stopping train as previously referred to. Stations between Horsham and Arundel are served *via* the Three Bridges route, by the stopping trains leaving that station at 17 min. and 47 min. past the hour, or by a change into these services at Horsham from the London suburban trains running *via* Dorking North.

Service Improvements

The present and previous timings from London to the principal towns served by the fast electric trains, and similar particulars for the coastal services are given in the first two of the accompanying tables, and the increase in the number of trains in the various services is indicated in the third table. The data in all these tables are simply those relating to ordinary weekday traffic, but on Saturdays and at holiday periods an increased number of trains will run. For example, on all Saturdays during the summer, there are 50 down and 42 up trains between London and Littlehampton, compared with 42 and 33 respectively on Mondays to Fridays; between London and Bognor Regis there are 26 down (including 24 through) and 29 up (including 25 through) trains against 19 and 20 on weekdays.

By the substitution of electricity for steam as the motive power for the Sussex coast trains, it has been found practicable to effect certain improvements in the Worthing, Brighton, Eastbourne, and outer London suburban services. For instance, the existing 5.47 p.m. from London Bridge has been retimed to start at 5.45 p.m., and now runs non-stop to Haywards Heath instead of stopping first at Horley and Three Bridges. The train is divided at Haywards Heath, one portion going to Ore and the other to Littlehampton. An additional train has been put on to cover the Horley and Three Bridges traffic, and forms also a convenient business service to the stations between Three Bridges and Horsham, and further south, too, for this train goes on to Bognor Regis and Portsmouth.

Yet another business service is given to the Three Bridges and Horsham line by detaching at Horley a portion from the 7.5 p.m. Victoria to Brighton train. In the opposite direction, the 6.33 a.m. train from Ore to London Bridge and the 7.45 a.m. from Brighton to London Bridge no longer combine at Haywards Heath. The Ore train now runs to Victoria, and the 7.45 a.m. from Brighton stops at Hassocks, to cater for the growing need of that district. The extension of the 6.33 a.m. Ore train will call at Three Bridges, Horley, Purley, East Croydon and Clapham Junction, in order to relieve the Tattenham Corner—London Bridge route, and to obviate some of the transfer traffic at East Croydon. On the Mid-Sussex route, the late theatre train to Littlehampton, Bognor Regis and Chichester, leaving Victoria at 11.55 p.m. every second Wednesday of each month, is being accelerated some 30 min.

Traffic Working

Track occupation is greatest in the neighbourhood of Barnham and Arundel junction and between Portsmouth and Havant. In each case diverging lines cause certain trains to cross the paths of others, and on the Portsmouth—Havant section there is further complication arising from the steam trains coming on to the line at Portcreek and Farlington junctions. Through steam trains

from Brighton to Bournemouth, Plymouth, and Cardiff still use the coast line, but have been accelerated slightly to correspond with the normal electric schedules. At holiday times excursions and specials from the west of England are frequently worked over the line from Farlington to Brighton, and this at a time when the Southern Railway's own electric traffic is denser than usual.

Between Portsmouth and Havant, without taking into account any of the long distance steam trains, goods trains, or light engine workings, there are seven trains an hour in each direction on weekdays; the four up trains which run on to the Chichester line must cross the paths of the three down trains from the Petersfield route, and as there is no parallel working through the four tracks at Havant all 14 trains are interdependent at the junction. On this section of the line on Saturdays during the summer there will be 10 electric trains an hour on each line, in addition to the steam services to and from the west of England, &c. The extremely interesting operation of traffic through the junctions forming the corners of the Ford triangle is shown on one of the accompanying drawings, and needs no further elucidation.

Head Codes

A considerable amount of thought has been devoted to the head codes carried by the various trains running over the newly-electrified lines with the object of giving at a glance as much information as possible. A study of the attached table will show that all the main line trains running *via* the direct line between Ford and Arundel junction have an even initial figure, whereas all trains running *via* Littlehampton have an odd initial figure. All London—Portsmouth trains running *via* the Mid-Sussex line and the direct line from Arundel junction starting from either Victoria or London Bridge have 2 as the initial figure, whereas those running between London and Portsmouth *via* Littlehampton have 7 as the initial number. Direct trains between London and Bognor Regis have 4 as the first number, whereas any running *via* Littlehampton have a head code beginning with a 9. Similarly London trains to Littlehampton *via* the Mid-Sussex line have 5 as the initial number.

In all services from London which run over the newly-electrified lines, the second figure in the head code indicates the route being followed over the first portion of the journey. For example, trains from Victoria routed *via* Mitcham junction carry 0 as the second figure whether running to Portsmouth, Bognor Regis or Littlehampton; the figure 6 represents the route *via* Quarry, and 8 that *via* Redhill and Horsham and a similar distinction has been made for trains starting from London Bridge. Numbers 80 to 89 inclusive are reserved for any future services; otherwise practically all numbers from 1 to 100 are now in use by Central Section electric trains.

Goods traffic over the electrified lines is still operated by steam locomotives. In addition, there are a number of parcels, light goods and fruit trains along the coastal line, and also from such places as Bognor Regis to Horsham and London Bridge, and at certain seasons the London-bound traffic, consisting mainly of fruit and vegetables, is quite heavy. It is to stable the engines required for these trains and for special excursions that the engine shed at Bognor Regis has been retained. Certain push-and-pull steam passenger trains still work over short stretches of the newly-electrified section, such as those between Midhurst and Pulborough, which come on to the Mid-Sussex line at Hardham junction, and the Guildford—Horsham sets, which run over electrified tracks between Christ's Hospital and Horsham. The Horsham—Steyning—Brighton steam trains also use the Mid-Sussex line between Horsham and Itchingfield junction.

Signalling Arrangements



Resignalling on a fairly complete scale is a necessary adjunct to an electrification such as the Mid-Sussex and Sussex Coast scheme, in order to reap the fullest advantage in operation afforded by the greater flexibility in motive power. There must be no half measures; unification of control at busy interlockings is no less important than the careful spacing of signals throughout the area to obtain a uniform headway. This latest electrification scheme of the Southern Railway provides by its very thoroughness a most interesting example of signalling modernisation. The traffic handled differs considerably from that of the main route from London to Brighton, and also from that of the Portsmouth Direct line. It is not beset with an intensely concentrated terminal traffic such as prevails at Portsmouth Harbour, and consequently the installations of multi-aspect colour-light signals are confined to a few key points such as Dorking, Horsham and Havant.

At Bognor Regis and Littlehampton the existing mechanical signalling has been entirely re-arranged; although mechanical point operation is retained, in conjunction with standard upper quadrant semaphore signals, both layouts are now track-circuited throughout, and by the provision of complete track locking on signal and point levers throughout the frames all the additional protection of a power interlocking is obtained. All points are electrically detected. At Bognor Regis a new 66-lever frame has been installed, but at Littlehampton the necessary electric lever locks and circuit controller have been fitted to the existing frame. Similar work, in each case linking up to an existing locking frame, has been carried out at Chichester, Barnham Junction, Ford Junction, Pulborough, and Crawley, and also along the coast line linking up with the Brighton and Worthing scheme, at Shoreham, Lancing, Portslade, Dyke Junction, and West Worthing. Some of these modifications have been dictated by the lengthening of platforms and revised track layouts for berthing of stock; in this connection careful

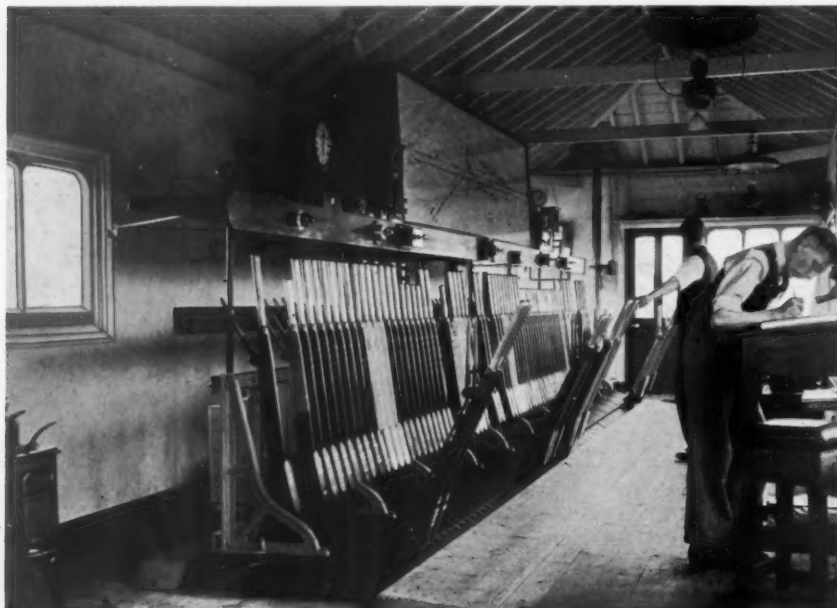
attention has been given to the signalling of all shunt movements, as experience in the London area has shown that this is of inestimable value in the expeditious manœuvring of trains. The shunt signals in colour-light areas are of the disc (or coloured-bar) type flood-lighted at night. At the interlockings mentioned, and elsewhere, a total of 150 new a.c. track circuits has been installed, and 57 d.c. track circuits converted to a.c.

Intermediate Sections

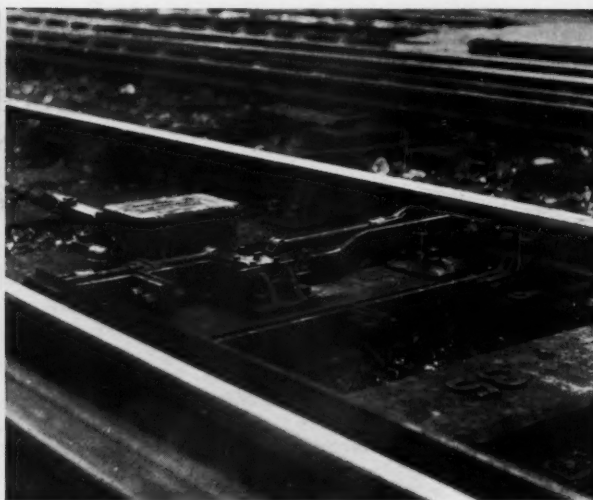
Careful provision has been made for a uniform headway of trains on all the newly electrified sections, and in 23 instances the existing sections have been roughly halved in length by the installation of intermediate two-indication colour-light signals; in each of these locations a home and distant signal is provided, and, although they are controlled from the signal box in the rear, from the traffic point of view they constitute complete intermediate block posts. Important examples of these intermediate signals are to be found on the heavily graded section between Dorking and Warnham; here, even with electric traction, slower running occurs and tends to lengthen headway unless some provision in the way of intermediate signals is made.

With the same object of improving the working at intermediate points special attention has been given to the number of level crossings situated in the area. At 14 level crossings where a gateman is on duty, block repeating indicators and bells have been provided; at four locations, where the gates were previously opened and shut by hand, mechanical operating gear has been installed for more expeditious working. Telephones have been installed on an extensive scale, both at signals (so that motor men may be able to communicate with the signal boxes), and at stations and halts (for linking up with the electrical control rooms).

Purely from the signalling point of view the most interesting work is to be seen at the interlockings where com-

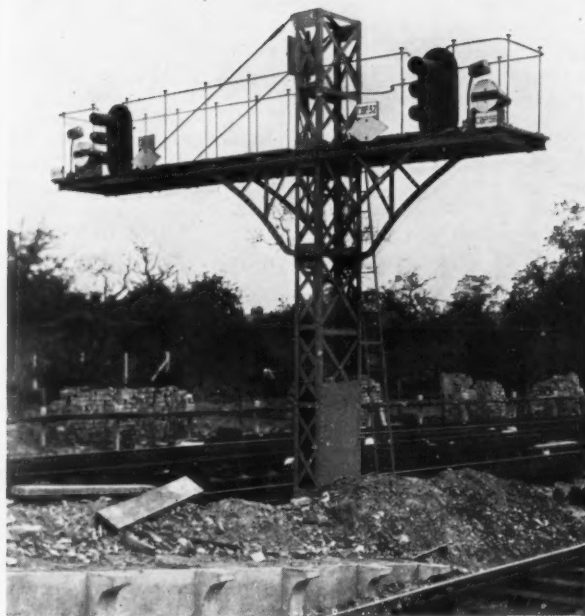


Interior of Havant box, showing the new electro-mechanical locking frame. On the quadrant is a special bracket fitting carrying the electric lever locks situated immediately behind the levers. This equipment, in common with the remainder of the new electric signalling apparatus in Portsmouth No. 2 scheme, is of Westinghouse manufacture



Above left: Shunt signal mechanically operated and flood-lighted

Above right: Mechanically-operated facing points with electric detector



Above: Horsham down starters; a typical bracket signal post with colour-light running signals and solenoid-operated shunt signals

plete re-signalling has taken place. Of these Dorking North and Horsham are typical examples. At both places colour-light signals are used throughout, with position light junction indicators for diverging routes. At the control points immediately preceding the colour-light area, as at Littlehaven halt, on the Three Bridges—Horsham line, approach lights are installed below the semaphore arm of the home signal; these are two-indication colour-light signals. When the semaphore signal is at "danger" no approach light is shown; when the semaphore is off the approach light shows either yellow or green according to whether the multi-aspect signal ahead is showing "danger" or a less restrictive aspect, *e.g.*, yellow, two yellows or green. At Dorking, only the outlying points are power worked, the majority being rod operated from the cabin; at Horsham most of the points are power worked, although a mechanical locking frame is used and the shunt signals are operated by wire, as at Dorking and elsewhere in the area. The new signal boxes at Dorking, Horsham, Arundel, and Bognor Regis are of an imposing modern design, fit symbols of the coming of electric traction to the quiet Sussex countryside.

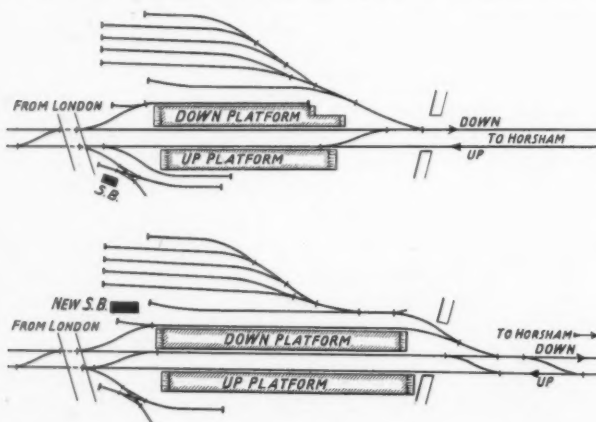


Right: The new electro-mechanically equipped box at Arundel

Civil Engineering Works

IN most electrification schemes of any magnitude, numerous engineering works are necessary in order to deal with the longer trains, and also to provide facilities for making up and dividing the trains, and these works must be done coincidentally with conversion. In addition, in all Southern electrifications the opportunity has been taken to modernise many station buildings and layouts, and the present scheme is no exception, for this forms a not inconsiderable part of the civil engineering work undertaken. All stations and halts have been altered to take either twelve-car express trains (Sutton, Dorking, Horsham, Pulborough, Arundel, Littlehampton, Barnham, Bognor Regis, and Chichester) or four-car sets, the nominal standard length in the first case being 820 ft. and in the second case 260 ft. Another work resulting directly from electrification is the provision of berthing sidings for electric trains, and these have been laid down at Warnham, Littlehampton, Ford, Barnham, and Bognor Regis, as well as at New Cross Gate and Streatham Hill, which are not actually on the newly-electrified lines. The re-positioning of cross-over roads clear of the platforms, and the lengthening of the platforms, has in many cases necessitated important alterations to the layout of the tracks.

At Dorking North the down bay has been converted into a loop, and the two platforms have been extended to accommodate twelve-car sets. This lengthening has involved widening the underbridge over Lincoln Road.

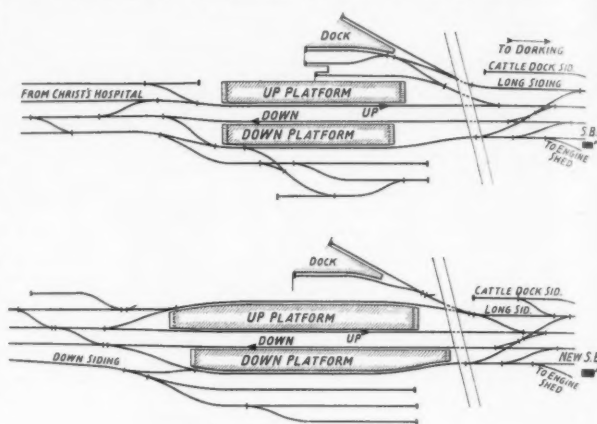


Layout of tracks, Dorking North station
top: old layout
bottom: present layout

At Three Bridges, platforms 3, 4, and 5, used by Horsham line trains, have been lengthened at the London end over the High Street. On the sections from Dorking North and Three Bridges to Horsham, little work has been done except for platform raising and lengthening, and slight re-arrangement of tracks (*e.g.*, moving the position of crossovers) and the provision of additional goods yard accommodation at Crawley. North of Dorking, the electrification of the Sussex lines has necessitated lengthening to 820 ft. the platforms at Sutton, where the Victoria—Bognor—Portsmouth hourly express trains will normally make a stop.

Horsham station is being completely rebuilt, and the track layout has been altered as indicated in one of the

accompanying diagrams. There are now two through roads and two loops, with island platforms serving up and down trains respectively. The old subway is being replaced by a footbridge, and a new block of station buildings erected on the up side. A passimeter booking office is also being provided on the down side. At Pulborough the lengthening of the platforms has involved alterations to the subway, as previously the headway of this was



Track layout at Horsham station
top: old arrangement
bottom: layout since electrification

on the platform ramp. The platform lengthening at Arundel necessitated re-arrangement of the goods yard access lines. Previously, the local trains from Littlehampton arrived at an up bay platform now incorporated in the goods yard, then reversed over to the down line and back again to the down bay ready for the return journey. By the provision of a facing crossover just south of the station, these trains are now taken direct to the down bay. A long retaining wall necessitated by the platform lengthening has been built to the south of the station, and there is a new signal box of the latest

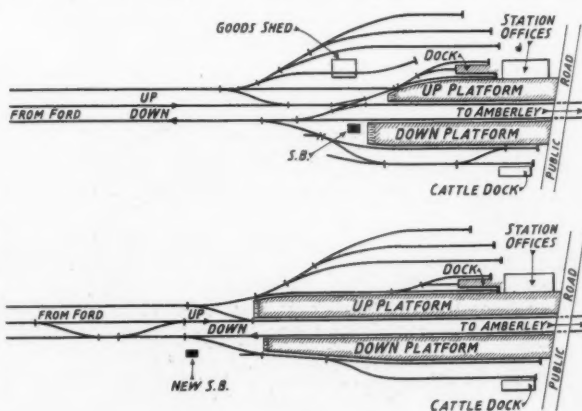
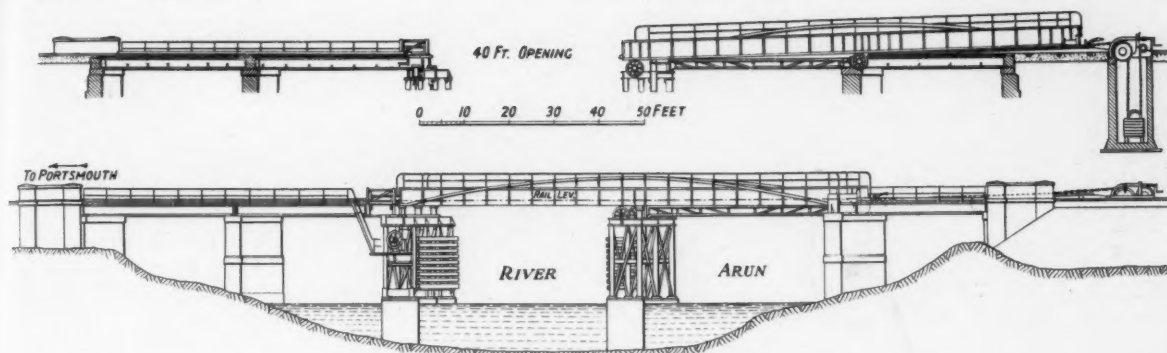


Diagram of tracks at Arundel
top: old layout
bottom: new layout



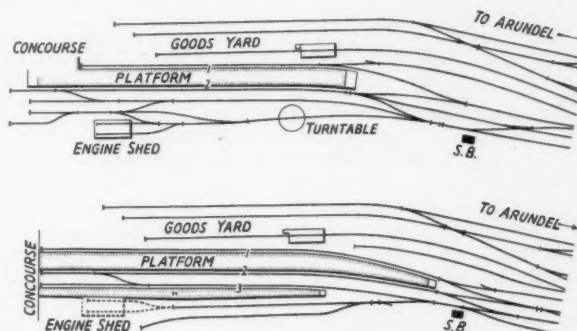
Drawing of the old roll and lift bridge at Ford as rebuilt in 1862

Southern standard type to the south of the down platform.

A distinct asset to traffic operation has been made at Ford by the conversion into a fixed structure of the 90-year old roll and lift bridge over the River Arun, and the removal of the speed restriction over it. It was Admiralty stipulations which led to the original bridge, built in the forties of last century to the designs of John Urpeth Rastrick, being made to open, so that ships could get up to Arundel. Little is known of this original structure other than what is conveyed by the woodcut reproduced with this article, except that it was single track and consisted of two movable trusses, viz., the draw span 144 ft. long, weighing 70 tons, and the track-continuity platform; both were mounted on carrying wheels 6 ft. in diameter. It was built by John Eede Butt, of Littlehampton. In 1862 it was replaced by a drawbridge, under the direction of Mr. Jacob Hood, then Chief Engineer of the "Brighton," and it is this structure, strengthened in 1898, which has lasted until the present reconstruction. It was built by Henry Grissell, of the Regent's Canal Ironworks, London. The method of opening and closing the span can be seen from one of the accompanying drawings. Of late years the bridge has seldom been opened to allow river traffic to pass, the last occasion being on April 5, 1936, and it has been considered unsafe for any of the heavier modern types of Southern steam locomotives, although the ex-L.B.S.C.R. Atlantics were allowed over it at slow speed. Parliamentary powers were therefore sought to rebuild it as a fixed bridge, and the conversion has just been completed under the provisions of Section 36 of the Southern Railway Act of June 10, 1937, the work being carried out coincident with electrification. During the past ten months the two piers in the river have been strengthened with reinforced concrete piles, and new

trestles have replaced the old. During the week-end of April 23-25 last, the superstructure of the old bridge was cut up into sections by burning, and removed; the new spans were placed in position by 36-ton breakdown cranes. Road services were run while the bridge was closed to traffic.

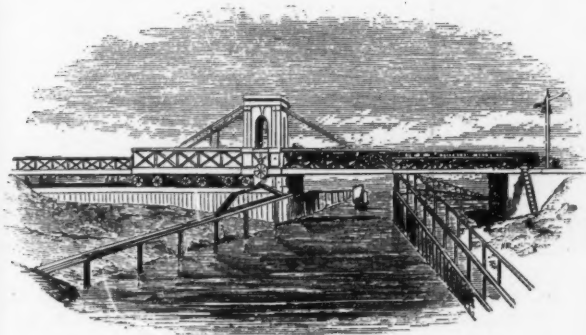
New station buildings and an additional platform for eight-car trains are being provided at Littlehampton, and the existing double-faced platform has been lengthened to take twelve-car trains. The old steam engine shed is to be pulled down, new electrified berthing sidings have been laid, and a three-road carriage shed of standard Southern construction, taking twelve-car trains, has been built. This shed is of steel framing covered with Big Six corrugated asbestos sheeting with ample glass lighting, and



Layout of lines at Littlehampton

top: old station

bottom: present station



*The original timber bridge over the Arun near Ford.
It had a clear span of 63 ft.*

contains the usual equipment for cleaning, inspection, and running repairs. At Ford, two sidings have been electrified for berthing trains.

No carriage-washing plant has been provided alongside any part of the newly-electrified lines, but Bognor Regis has been equipped with flood-lighted cleaning stages and some new berthing sidings. The two island platforms have been lengthened for twelve-car rakes and a new signal box has replaced the previous two boxes. The existing steam engine shed has been retained for the use of engines working goods, parcels, and fruit trains. At Barnham, the junction for the Bognor branch, the platform lengthening extended over a culvert, and this involved further tipping for the widening of the embankment. A facing connection to the down bay has been provided for down trains. Another minor work at Barnham was the electrification of two carriage sidings.

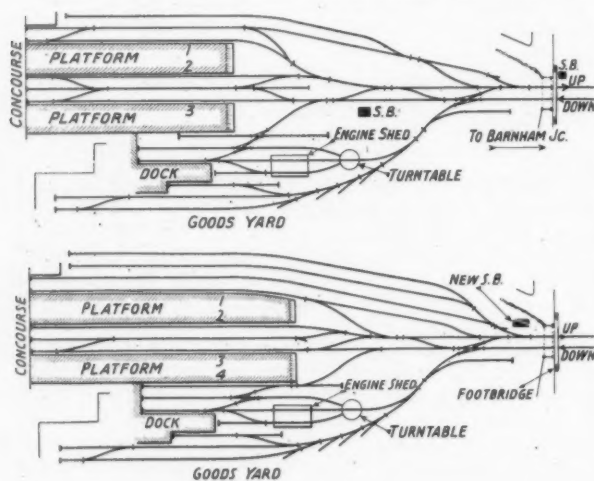


View of station rebuilding works in progress at Horsham, looking south

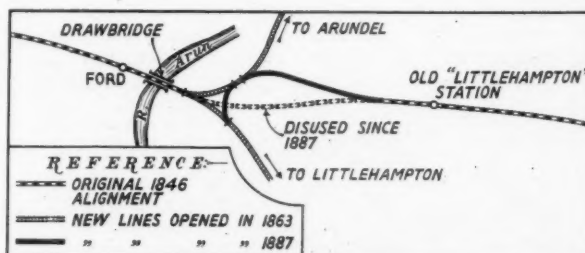
Completely new station buildings are being provided at Chichester, where the two main platforms have been lengthened to 820 ft. and a down bay platform provided for the local service between Chichester and Portsmouth. A short length of the old Chichester—Midhurst line has been electrified to facilitate the shunting of electric trains. The existing halts between Chichester and Havant have all been raised to the dignity of stations with booking cabins, and have been lengthened to take four-car trains. At the other end of the coastal line, Worthing, Goring, and Shoreham stations have been provided with longer platforms, to accommodate through trains from London,

which previously were divided at Hove. Immediately to the west of West Worthing station the old down line has been turned into a long central siding so that trains terminating there can run straight from the down line into the siding, ready to reverse into the up platform for the return journey.

Among the general works undertaken by the Chief Engineer's Department, in addition to the signalling, which is described in a separate section, have been the erection of the new standard close-mesh fencing with barbed wire along the top, and the construction of cattle guards at the level crossings. The provision of so much new electric stock to operate over the newly-converted



Arrangement of lines at Bognor Regis
top: old layout bottom: present layout



Layout of lines near Ford, showing opening dates

lines has necessitated the building at Streatham Hill of a mechanical washing plant and a new carriage shed housing four twelve-car and four eight-car trains. At Slades Green, too, a couple of new bays have been added to the repair shops to cater for the new Sussex trains. All the 100 lb. conductor rails have been laid by the engineering department, and another responsibility was the erection of 20 substation buildings and 19 track-paralleling huts.



View of the bridge over the Arun at Ford showing new fixed spans in position



New car shed and pre-cast concrete footbridge under erection at Littlehampton



Typical footbridges near Chichester replacing foot level crossings



The widened Lincoln Road bridge at Dorking, taking the ends of lengthened platforms

MISCELLANEOUS ENGINEERING WORKS ON THE PORTSMOUTH NO. 2 SCHEME

Power Supply and Distribution

THE power supply and distribution system has been designed to link up with existing supplies, with the addition of a new supply from Leatherhead and Three Bridges C.E.B. substations. In all there are now four feeding points, viz., Wymering C.E.B. *via* Havant substation, Fishergate C.E.B. *via* West Worthing substation, Three Bridges C.E.B. substation and Leatherhead C.E.B. substation (see switching stations on full page map). Alternative e.h.t. supplies are thus available to all substations under practically any emergency condition.

In taking a new supply from the Leatherhead C.E.B. substation the opportunity was used to replace the existing rotary converter substations at Leatherhead and Dorking by new unattended mercury arc rectifier substations. Dorking substation contained two 1,250 kW. rotary converter sets and was manually operated. One of these sets has been transferred to Epsom substation and the other set to Hampton Court Junction substation, both of which required an increase in capacity to cope with the additional electric services. The Leatherhead plant, which is a single automatic unit, is being transferred to a new substation on the Chessington line. Altogether 20 new mercury arc rectifier substations and track-paralleling huts have been built, and all are identical with those previously built for the other electrified main lines to the south coast. There are now in service 87 such substations and they are quite a well known feature of these routes. Their positions and the nature of their equipment is indicated on the map on the second page of the present issue of this Supplement.

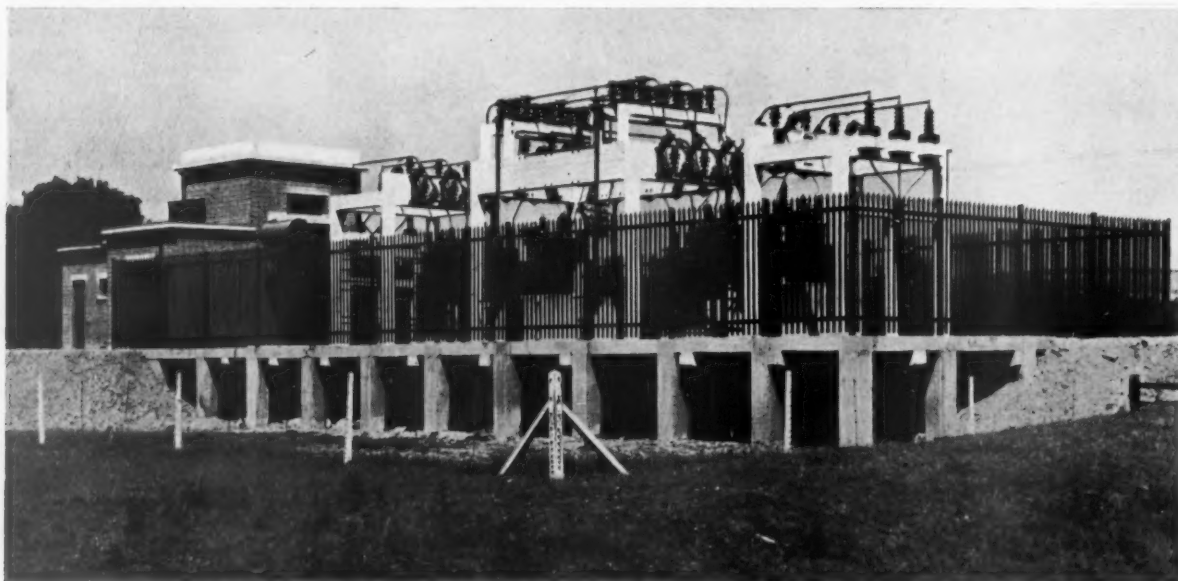
Seventy-seven miles of three-phase high-tension 33 kV. cable have been laid along the railway line, carried in the usual manner in wooden troughs supported on concrete posts, except where local hazards necessitate laying in concrete ducts at ground level. The number of such cable diversions has been considerable in this scheme, for in addition to the 29 railway stations so treated there are no fewer than 198 level crossings, all of which have made



Close up view of the 2,000 kW. rectifier substation at Arundel junction

necessary cable route deviations and conductor-rail gaps. In completing the cable route before the new Ford bridge was ready, a temporary wooden bridge was constructed to carry the cables until such time as the new bridge and cable trough were ready, into which position the cables were finally moved.

Running concurrently with the power cables are a four-core pilot cable for selective protection purposes and a multi-core cable for the supervisory control system, containing 17 or 33 cores depending on its location with respect to the control room from which it radiates. The control room is at Havant, which, in addition to controlling the substations as far as Liss on the Portsmouth



South Stoke substation showing the concrete platform founded on 50-ft. reinforced concrete piles driven into the marshes round the River Arun



Arundel junction looking east, showing main line electric train coming off the Arundel line and running in the direction of Ford; the substation is on the right

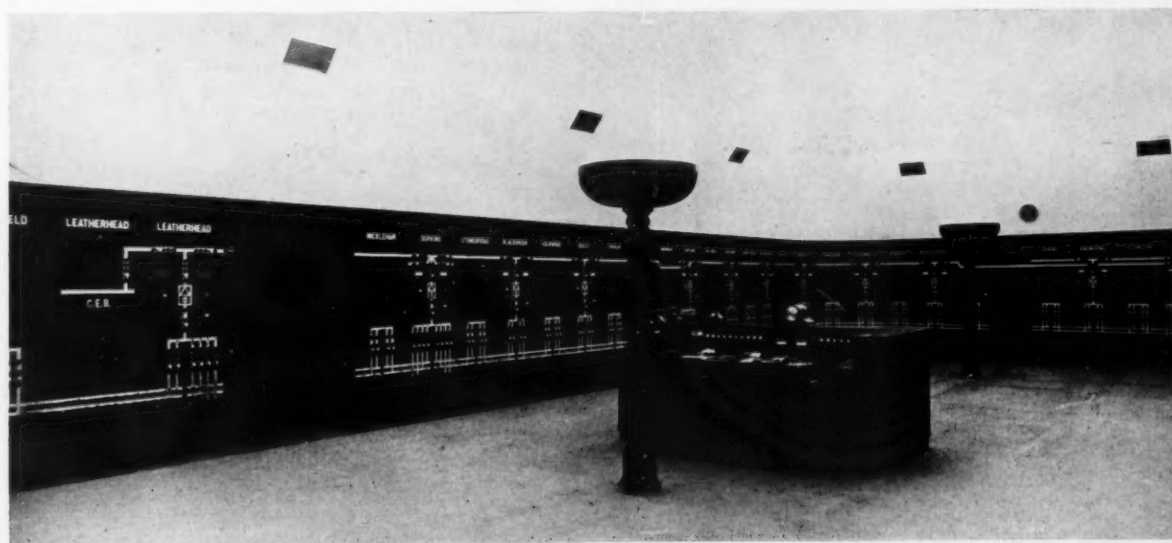
direct line, controls all the substations on the new Portsmouth No. 2 extension.

These are identical with those on previous extensions and consist of two sections, viz., an e.h.t. switchgear outdoor structure section, and a rectifier and l.t. switchgear building. The standard layout comprises three 33 kV. oil circuit-breakers arranged as two incoming feeders and a tee-off connection from the busbar system created by the two incoming feeder equipments. The supply is thus made available to the mercury arc rectifier equipment in the building via the rectifier transformer standing outside one end.

This building also contains the necessary d.c. high-speed circuit-breakers required to distribute the d.c. energy to the various tracks. There are additional e.h.t.

feeders at Barnham, Ford, and Horsham substations, and at Dorking substation provision has been made for extension in the event of its being necessary one day to electrify the Redhill—Guildford line. Fuller details of the substation equipment were given in the issue of this Supplement for June 25, 1937, which described the Portsmouth No. 1 scheme.

To the 14 panels at Havant for operating a section of the Portsmouth No. 1 scheme, 44 panels have been added to cover the complete supervisory operation of all the substations and track-paralleling huts on the Portsmouth *via* Horsham extension. The equipment is of the same design and principle as that already existing and full details can be obtained from the description given in last year's Supplement for Portsmouth No. 1 extension.



Interior of Havant control room, showing the panels added last year to cover the substations and track paralleling huts of the Mid-Sussex and Sussex coast electrification

Rolling Stock



A TOTAL of 292 vehicles has been provided for the operation of the newly electrified lines, and comprise 68 two-car corridor sets, 26 four-car vestibuled sets, and 13 four-car vestibuled sets each with a buffet car. All these coaches were built or reconstructed from existing stock at the Eastleigh and Lancing works. The four-car sets are used for the express services and the two-car units for local and outer suburban trains.

With the exception of the buffet cars, the new stock follows closely the design of that provided in connection with the electrification of the Portsmouth Direct line, which was illustrated and described in the issue of this Supplement for June 25, 1937. The four-car sets consist of two third class motor coaches of the saloon type, with a driving compartment, a first and third composite, and a corridor third of the compartment type. This last-named coach is replaced by a buffet car in 13 of the four-car sets.

Standard motor bogies are fitted at the driving ends of each motor-coach, and trailer bogies are used elsewhere. The underframes and bogies are built up of rolled steel sections, with the members riveted together; the underframes are fitted with Spencer-Moulton self-contained anti-collision buffers with indiarubber springs. The body framing is teak, covered on the outside with galvanised steel panels. The floors of the motor and trailer coaches, and also of two of the buffet cars, are of Induroleum or Decolite carried on corrugated steel sheets. The remainder of the buffet cars have double-boarded floors, with a layer of Lloydboard $\frac{1}{4}$ -in. thick on the underside to deaden the

sound. The boarded roof is carried on steel carlines and is covered with canvas. The open vehicles are fitted with fixed side lights with sliding shutter ventilators above them, the fixed lights being carried in Alpax frames. The drop-lights in the doors are of the Beclawat Weatherproof frameless type.

Indian silver greywood is used generally for finishing the first class portions of the trailer composites, and the compartments have panels below the racks relieved by either Australian blackwood or Indian laurel. In the third class compartments Nigerian walnut is used entirely for finishing, and in the saloons of the motor coaches African mahogany is used. The seats, which, as usual in Southern Railway stock, have loose well-sprung cushions, are upholstered in moquettes, the colours of which harmonise with that of the woodwork.

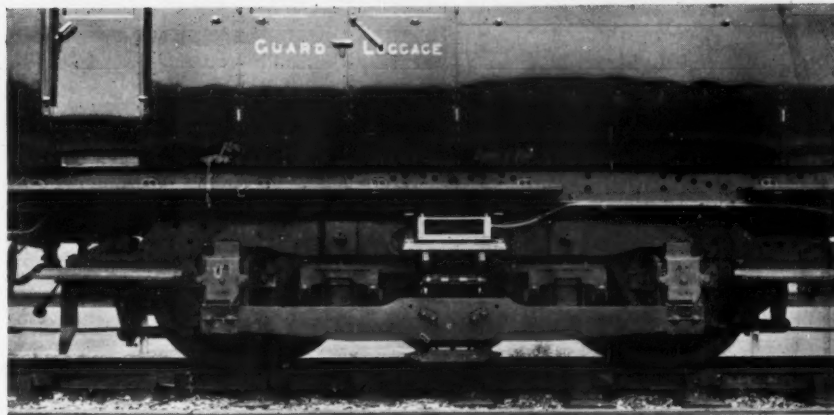
Buffet Cars

The buffet cars are a new type of vehicle so far as the Southern Railway is concerned. Each car contains a kitchen, a bar section, a saloon section and two lavatories separated from the saloon section by a cross gangway. The saloon section had to provide seating for 16 passengers and the problem was solved in an original manner by fitting specially shaped tables in front of each side light. The edge of the table top consists of four concave curves at each of which a revolving chair is provided. This arrangement gives each passenger ample table room and, at the same time, provides a greater circulating area and



General view of one of the two-car corridor sets

View of motor bogie showing current collecting shoe and wooden carrying beam supported by the two axleboxes



thereby facilitates the service. The front edge of the bar counter also consists of a series of curves, and a high stool with a circular top free to revolve is located at each. The rubber-covered foot rail also follows the same line. The edge of the intermediate partition has been made to follow the same design, which has also been applied as a decorative motif to the end partition.

The decoration follows modern lines. The bar and saloon portions are painted throughout in a special shade of light stone, and the walls and ceilings are flush finished. The floors are carpeted with a black Royal Wilton one-piece carpet with old gold engrailed diagonal stripes. The neutral walls and black floor provide the necessary background for the vivid jade green or wine red and gold of the upholstery of the chairs and curtains.

The edges of the tables and the counter and of the partition and shoulder rests are finished in rubber of the above colours, and the tables and counter tops are covered in plain light stone-coloured indiarubber to match the walls. The sheet metal pedestals of the revolving chairs have a shelf for gloves and other small articles.

A decorative feature of some artistic interest is to be found in the saloon section. A series of plaques finished in antique brass, relieved on the high lights, and specially designed by Mr. G. Kruger Gray for these cars, has been fitted in groups between the side lights and on each side of the double-swing door into the vestibule. These plaques represent subjects selected as being appropriate for use in a buffet car, viz. (a) pork and apple sauce, with, in the border, sausages and beans; (b) chicken and asparagus, bread sauce, corn, with, in the border, eggs and toast; (c) vegetables (cabbage, carrots, potatoes), with, in the border, radishes; (d) fish (hake, cod and sole), and in the border shrimps, cockles and mussels; (e) beef and Yorkshire pudding, and in the border horse-raddish and oxtail soup; (f) lamb cutlets and mint sauce, and in the border sheep's hearts.

The plaques are made by the Kupron process which

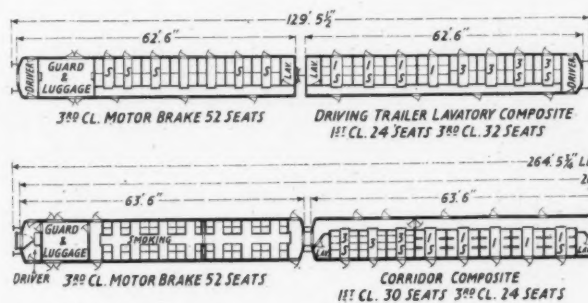
allows for the exact reproduction from the original artist's sculptured master models. Reverse moulds are made in the best Cafferata plaster of exact purity. The moulds are then subjected to a special process of impregnation which hardens and preserves the plaster and causes the deposited Kupron metal to adhere to it firmly. This then enables the electric deposition of the copper to take place, which produces a true reproduction of the artist's design.

In the bar section the wall opposite the counter has no window lights, so as to ensure greater privacy. In order that passengers standing against the body side may do so as comfortably as possible, the body side has been divided into six sections by screens projecting a convenient distance from the side, each section being wide enough to allow two passengers ample room between the screens. A show case is fitted on the kitchen partition. All metal fittings in the saloon and bar sections are vitreous enamelled in the same colour as the upholstery material used in the particular car. The carpet is laid over indiarubber on linoleum.

The bar and saloon portions are illuminated by architectural tubular lamps in the roof, there being a line of these lamps down the middle of the roof except at the fans, each of which is encircled by segmental lamps. Table lamps are also provided.

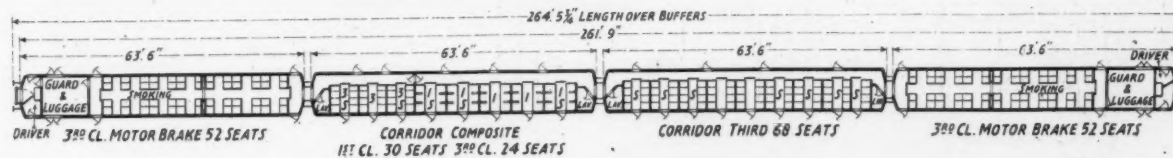
Stone's system of pressure ventilation equipment has been fitted, and continuous supplies of filtered fresh air are delivered by ducts at floor level. In addition four Imperiston porthole exhaust-type fans are provided in the roof, one in the cafe, two in the buffet and one in the kitchen section. The kitchen is also fitted with MM Monsoon ventilators.

Stainless steel is used in the kitchen for the table tops and for those portions of the walls which are likely to become dirty in service. Above the stainless steel the interiors are white enamel. Below the table tops the woodwork is painted mahogany colour. The walls of the vestibules have been finished with cream-coloured



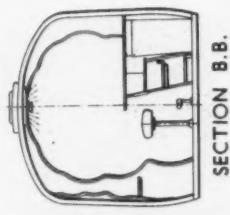
Top : Diagram of two-car corridor non-vestibled set

Bottom : Diagram of four-car main line set without buffet car

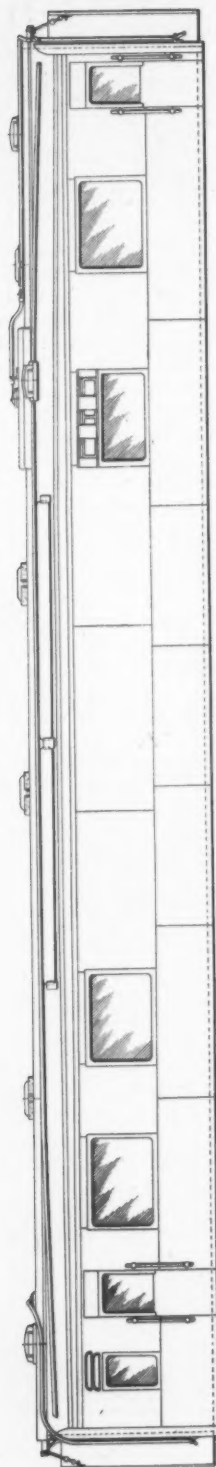




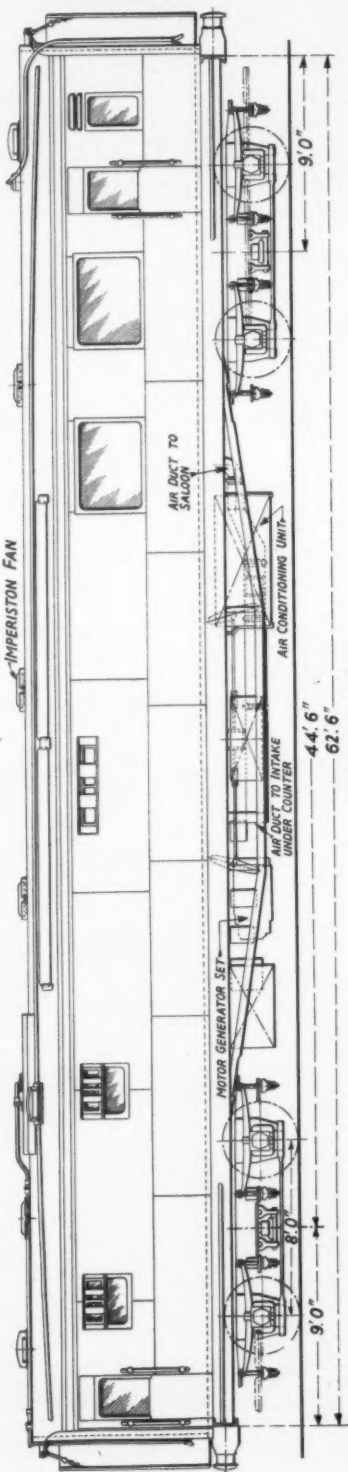
SECTION A.A.



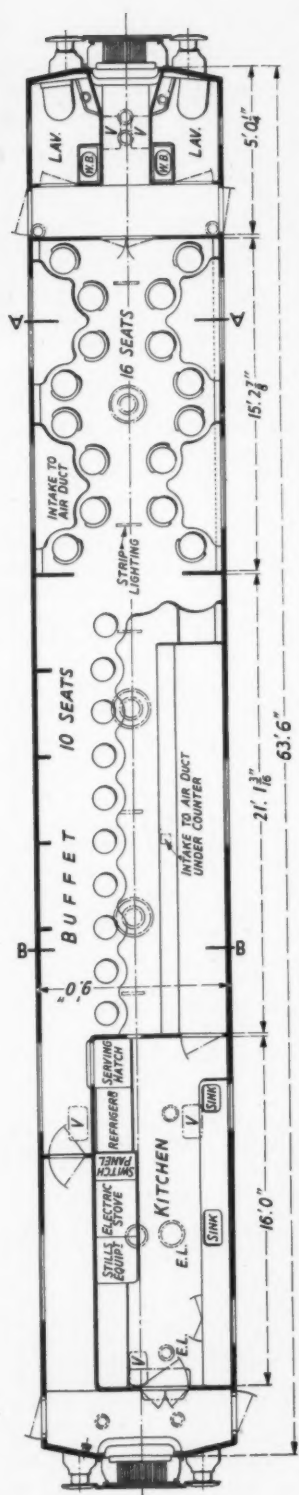
SECTION B.B.



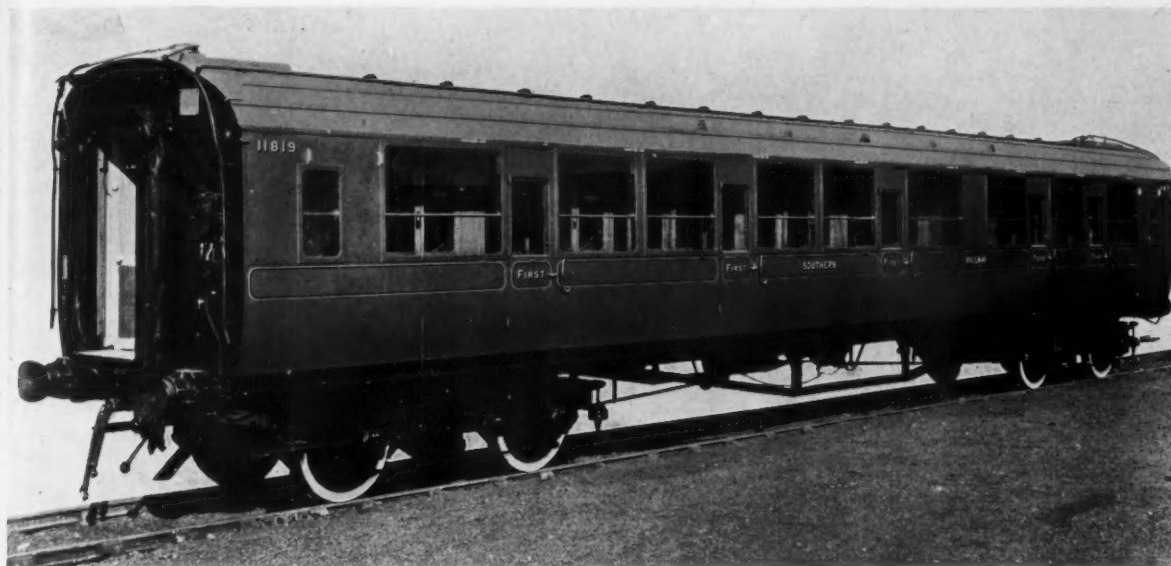
CORRIDOR SIDE



KITCHEN SIDE



General arrangement of the new non-motor bogie buffet cars used on the London-Portsmouth via mid-Sussex express electric trains



Southern Railway composite trailer car for use in electric trains

Rexine of a deeper shade than that of the rest of the car and this material has also been employed in the two lavatory compartments, which are fitted with modern toilet equipment. To aid ventilation, Vent Axia fans have been fitted in the roofs. Terrazzo mosaic flooring has been used. Special attention has been paid to silencing the cars. Double glass windows are fitted, the

undersides of the floors have been covered with sprayed asbestos, and the walls and roofs have been lined with acoustic asbestos blankets.

Electrical Equipment

The traction control equipment of the two-coach sets is of the underframe-mounted electro-pneumatic unit-switch type. The low-voltage control circuits are fed from a potentiometer, and the control is arranged to multiple with the 660-volt suburban electro-magnetic equipment by means of four small train line contactors on each motor coach fitted with e.p. control. Experience with this arrangement has been perfectly satisfactory. Each motor-coach has two type 339 totally-enclosed traction motors of 275 h.p. at the one-hour rating. Including the motors provided for this extension there are now some 2,400 of this type of motor in service on the Southern Railway.

The traction control equipment on the express four-car trains is of the underframe-mounted electro-pneumatic unit-switch type, with low voltage control circuits fed from motor-generator sets mounted one on each motor-coach. The motor-generator sets also provide a supply for lighting and for battery charging. Each motor-coach is fitted with two type 163 totally-enclosed traction motors of 225 h.p. at the one-hour rating. Including the motors for this extension there are now some 690 of this type in service on the Southern Railway. Nife batteries are provided on each motor coach to give an emergency lighting supply in the event of a current failure.

The kitchen equipment of the buffet cars is of Stone's all-electric type and consists of a cooking range with four boiling plates, two grills, one roasting oven and a hot press for plates. There is also a Still boiler, coffee-making machine and milk boiler, and a refrigerator. The ovens and coffee machines have 660-volt heating elements which are totally enclosed and inaccessible to the kitchen staff. The grills and boiling plates have protected heating elements which are inaccessible except by misuse.

In order to eliminate danger to the kitchen staff the supply to these last items is given from a motor-generator set with a 70-volt d.c. output. The motor-generator sets on the buffet coaches are interchangeable with those on the motor-coaches, and in order to use their capacity to



End view of main-line motor coach



Interior of brake and luggage compartment showing how access is obtained to the batteries

the fullest extent, the switching for each grill is interlocked with that of a boiling plate so that either grill or plate may be switched on, but not both at once. The arrangement of these items is generally similar to that of corresponding items on the kitchen cars built last year for the Portsmouth direct line, except for the refrigerator, which was given an l.t. supply in that instance, and which now has a 660-volt supply in order that it may be worked when the l.t. supply is shut down.

In both the two-car and four-car trains a Heatrae electric water heater is fitted below each lavatory basin to give a constant hot water supply for washing purposes. The electric supply to these heaters is thermostatically controlled.



Contractors

General Engineering

- Dorman, Long & Co. Ltd. : Steelwork and Cladding—Streatham Hill carriage cleaning shed.
- Dawnays Limited : Steelwork for platform roofing extension, and Littlehampton cleaning shed.
- A. & J. Main & Co. Ltd. : Steelwork and glazing—Slades Green shed.
- Barrow Hamatite Steel Co. Ltd. : Conductor rails and fishplates.
- Grover & Co. Ltd. : Conductor rail fishbolts.
- C. Richards & Sons Ltd. : Cable trough straps.
- Wolverhampton Corrugated Iron Co. Ltd. : Robertson's protected metal for carriage washing machine at Streatham Hill, and booking offices at halts on coast line.
- Guest Keen & Nettlefolds Limited : Screws, bolts, &c.
- Burt, Boulton & Haywood Limited : Creosoted timber troughing.
- Whitehead Iron & Steel Co. Ltd. : Reinforcement.
- Cement Marketing Co. Ltd. and Eastwoods Cement Limited : Cement.
- Wraysbury Sand & Gravel Co. Ltd. : Sand ballast and shingle.
- Vaughan Crane Co. Ltd. : Pulley blocks for substations.
- Veronese Company : External rendering of substations.
- Shutter Contractors Limited : Roller shutter doors for substations.
- John Shelbourne & Co. Ltd. : Ford bridge.
- Westinghouse Brake & Signal Co. Ltd. : Signalling equipment.

Electrical Equipment

- Asea Electric Limited : H.T. switchgear and supervisory control equipment.
- British Insulated Cables Limited : L.T. cables and track bonds. Inspection shed overhead trolley equipment.
- British Thomson-Houston Co. Ltd. : High-speed circuit breakers.
- Bruce, Peebles & Co. Ltd. : Mercury arc rectifier equipment.
- S. F. Bowser & Co. (London) Ltd. : Oil store equipment.
- A. W. Campbell (successor to the Chatteris Engineering Company) : Repair shop cranes.
- Chloride Electrical Storage Co. Ltd. : Substation and control room batteries.
- English Electric Co. Ltd. : Electric train equipments.
- W. T. Henley's Telegraph Works Co. Ltd. : Multi-core cables.
- Pirelli-General Cable Works Limited : High tension and pilot cables.
- Pritchett & Gold & E.P.S. Co. Ltd. : Emergency lighting (Nife) batteries.
- Siemens Electric Lamps & Supplies Limited : Lamps.
- Taylor, Tunnicliff & Co. Ltd. : Third rail insulators.
- Westinghouse Brake & Signal Co. Ltd. : Motor-driven air compressors.

Rolling Stock

- J. Stone & Co. Ltd. : Electric cooking plant.
- W. M. Still & Sons Limited : Coffee making machines and boilers.
- Beckett, Laycock & Watkinson Limited : Door window fittings and sliding door gear.
- Hallam, Sleight & Cheston : Light frames and rubber fittings.
- Mead, McLean & Co. Ltd. : Air-stream ventilators and vitreous enamel fittings.
- Geo. Spencer, Moulton & Co. Ltd. : Self-contained buffers and decorative rubber mouldings, &c.
- J. W. Roberts Limited : Asbestos spraying of floors and sound insulating materials.
- I.C.I. (Rexine) Limited : Rexine.
- Edward Lloyd Wallboards Limited and W. A. Bonnell (1924) Limited : Hardboard.
- Steel, Peech & Tozer : Wheels and axles.
- Taylor Bros. & Co. Ltd. : Wheels and axles.
- T. F. Firth & Sons Limited : Carpets, rugs and moquette.
- Westinghouse Brake & Signal Co. Ltd. : Westinghouse brake and fittings.
- Marco Refrigerators Limited : Refrigerating plant.
- Doulton & Co. Ltd. : Lavatory fittings.
- Guest, Keen Baldwins Iron & Steel Co. Ltd. : Steel plates.
- N. F. Ramsay & Co. Ltd. : Door locks and fittings.
- J. Beresford & Son Limited : Door locks and fittings.
- Joseph Kaye & Sons Limited : Door locks and fittings.
- J. Summers & Sons Limited : Steel panels and sheets.
- Baldwins Limited : Steel panels and sheets.
- Lightalloys Limited : Alpac light frames.

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